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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

A. W. BORTHWICK, D.Sc.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

VOL. XXXIII.

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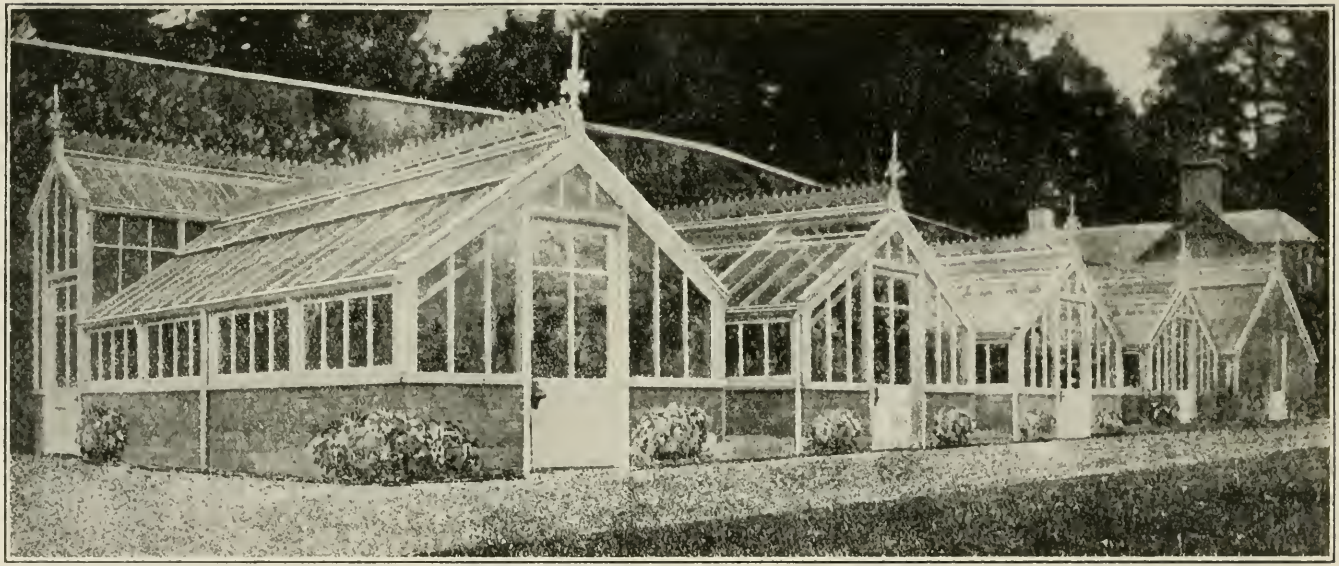

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Royal Scottish Arboricultural Society

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CONDITIONS OF MEMBERSHIP (excerpted from the Laws).

III. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible for election as an *Ordinary* Member in one of the following Classes:—

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

1. Discussion on Forestry Administration and Forestry Education at the General Meeting held on 3rd July 1918.

The Duke of Buccleuch, President of the Society, who was Chairman of the Meeting, called on the Secretary to read the resolution on Forestry Administration, which was in the following terms:—

"This General Meeting of the Royal Scottish Arboricultural Society welcomes the announcement that a Committee of the Cabinet has the question of Forestry Administration under consideration.

"The Meeting desires to impress on Lord Curzon and Mr Barnes the paramount necessity (1) of placing the Central Control of Forest Policy under men conversant with the subject; (2) of freeing the local administration in Scotland from the subservience to agricultural administration under which it has hitherto laboured; and (3) of making immediate progress with the replanting of cleared areas and the planting of large additional areas, so that public opinion may be satisfied that steps are being taken to protect the country from the grave national danger of a timber famine in the future.

"The Meeting respectfully repeats to the Government a request made to the Minister of Reconstruction that this Society should have an opportunity of considering and expressing its views upon schemes in contemplation before they are actually adopted."

Mr A. D. Richardson, Edinburgh.—"I have been asked to move this resolution, and I am sorry that some one more able to do justice to it than I am has not been selected for the purpose. In the first place, I think it is a matter of much

satisfaction to this Society that this question has got the length of being considered by a Committee of the Cabinet. For more than sixty years now this Society has been agitating to get forestry recognised as a great national industry, but very little progress has been made. Royal Commissions and Departmental Committees have collected evidence and have reported on various occasions, but apparently all these reports have been pigeon-holed, and we are just where we were. The report by the Forestry Sub-Committee of the Reconstruction Committee, however, has had some effect both with the Government and outside it, and there is evidently some prospect now of something being done. The first part of the resolution is to welcome the announcement that a Committee of the Cabinet has the question under consideration. I think every one in the Society will agree to that part of the resolution at any rate.

"The second paragraph of the resolution says:—'The Meeting desires to impress on Lord Curzon and Mr Barnes the paramount necessity of placing the Central Control of Forest Policy under men conversant with the subject.' Of course we are assuming that a Central Authority is to be set up, and when that Central Authority is set up I think it is very important that the control of policy should be placed in the hands of men who are conversant with the subject. I take that to mean conversant with forestry in this country. They may be, of course, conversant with forestry in other countries, but I think the essential thing is that they should also be conversant with forestry in the United Kingdom. We do not want to have this Central Control in the hands of men who do not know about home forestry. Forestry is a very intricate thing. Some people evidently consider it a very simple matter, but it is a very complicated thing compared with agriculture and horticulture. In agriculture you have annual crops, and if a farmer or an agriculturist of any kind makes a mistake one year he can rectify it the next. A gardener may make a similar mistake, but he can also rectify it in a very short time. But forestry is a very different thing. In forestry if mistakes are made in the course of a rotation a very great loss may be incurred, and over and above that a great deal of time may be lost. It is very important that the men in control should be men highly skilled in forestry, and that they should also have as perfect a knowledge as possible of the forestry conditions in this country.

"The second part of paragraph 2 says:—'The Meeting desires to impress on Lord Curzon and Mr Barnes the paramount necessity of freeing the local administration in Scotland from the subservience to agricultural administration under which it has hitherto laboured.' I know there are a considerable number of people who think that forestry should be subordinated to agriculture, and that it should be placed in Scotland under the Scottish Board of Agriculture. It has been under the Scottish Board of Agriculture for the last seven years, and in these seven years the Board has done nothing. The Development Commissioners have been in existence since 1909, and with the exception of some very small things nothing has been done by the Government. Inverliever is of course out of account. Inverliever is not administered by the Scottish Board at all. It is administered by the Department of Woods and Forests, an English Board, and I rather think Inverliever was in existence before the Scottish Board of Agriculture. I think most people who are conversant with forestry will agree that it would be very much better, very much more to the advantage of forestry, if forestry was carried on altogether apart from agriculture. We do not want, as some people seem to assume, to interfere with agriculture in any way, and I am sure that those agriculturists who have imagined that we wanted to interfere with agriculture are entirely mistaken. Some of the agricultural bodies apparently have taken up the attitude that we wanted to do them some harm, and to plant land which should be under agricultural crops. A deputation from one of the agricultural bodies actually asked the Secretary for Scotland that the Board of Agriculture should have power to prohibit afforesting agricultural land. I do not think any one in his senses wants to afforest good agricultural land. There is a great deal of good land in places where it cannot be utilised for growing farm crops, and a great deal of good timber, hardwood timber especially, could be grown on that land, but that of course would not interfere with agriculture. The main object, I think, is to get the waste land put under timber, land which is not good enough for agriculture and that would be excellent land for growing trees. I do not see that we would, in advocating afforestation of that land, interfere in the least with the farming industry. In fact, I rather think it would be of great assistance to the farmers. At any rate, from what one sees in

continental countries, where forestry is practised along with agriculture, it seems to be a very beneficial thing, and I am sure more than it yields at present could be got out of a great deal of the land were it under trees.

"Then the third part of paragraph 2 says:—'and of making immediate progress with the replanting of cleared areas and the planting of large additional areas, so that public opinion may be satisfied that steps are being taken to protect the country from the grave national danger of a timber famine in the future.' I think it is very necessary that some immediate steps should be taken to replant those cleared areas, or at any rate those cleared areas which ought to be replanted. Perhaps all should not be replanted, but those which ought to be replanted should be taken in hand as soon as possible, as well as the planting of large additional areas, so that public opinion may be satisfied that steps are being taken to protect the country from great national danger in the future. If it had not been for the foresight of a great many of the landowners of the country who planted extensively a century ago and more, I do not know what this country would have done in the present crisis. If it had not been done by these men there would have been a timber famine, for we have got nothing from abroad, and we would have had nothing else to depend on. Besides, what has been done has been an object-lesson to the Government of what can be done in the way of growing timber in this country. It is, I think, very essential that public opinion should be satisfied in this respect. If it were neglected and were another big war to break out—we hope this war will end all wars, but, on the other hand, no one can tell, and it is best to be ready for emergencies of that sort—we may be perfectly certain there would be an outcry in the country about it, and I think it is well to have it impressed on the Government that it ought to be done immediately. I also think, in connection with the satisfying of public opinion in this matter, that the question of placing the control of forest policy under men who know the subject is essential in order to satisfy the public that the thing will be carried out in a proper way.

"The last paragraph of the resolution says:—'The Meeting respectfully repeats to the Government a request made to the Minister of Reconstruction that this Society should have an opportunity of considering and expressing its views

upon schemes in contemplation before they are actually adopted.' I think most members of the Society will agree that this Society, if it has not the right to consider the scheme or schemes, ought, at any rate as a matter of courtesy, to have some say in the matter. This Society, as you all know, is the oldest forestry society in the United Kingdom, and it has done more, I think, to advance forestry than any of the others. The sister agricultural society, the Highland and Agricultural Society, has also done a great deal for forestry in the past, and it is largely due to the Highland and Agricultural Society that we have so much timber in the country, because even before this Society was in existence the Highland and Agricultural Society was encouraging forestry in Scotland. I think that both these societies ought to have some say in the matter, but I think the members of the Cabinet should, before adopting any scheme, at least entertain the views of the members of this Society, especially as it is the leading forestry society in the country. I have much pleasure in laying this resolution before you."

Mr Robert Allan, Polkemmet.—"I have much pleasure in seconding this resolution which has been put so ably before you by Mr Richardson. I am very glad that Mr Richardson has made it quite clear that there is nothing antagonistic between our Society and the agricultural societies. I think agriculturists woke up one morning with the idea that the whole of the land in Scotland was going to be planted with trees, and they immediately made up their minds to send a deputation to the Board of Agriculture to protest against this. I spoke to one member of that deputation and asked what it really meant. 'Oh,' he said, 'it is just trees, overhanging branches, spoiling crops which ought to grow food for the people.' I said, 'If that is all, that does not concern our Society, because that is not forestry at all.' So that was his idea as to the work of this Society. With reference to the Control Board that we want, we have had seven or eight years of the Board of Agriculture and they have done nothing. At the meeting when our Society accepted a resolution to have a Central Board for the United Kingdom the view was put forward, like the parable in Scripture, that we should allow the tree to grow another year or two, that we should dung it and put it in good order, and we might expect fruit in a short

time, but I do not think this war-time, after what we have learned during the war, is a time for delay. We do not want any more talk, but we want something done. This Society went to the Board of Agriculture and pressed their views that something ought to be done a few years ago, and what was the answer? After some talk they were told, 'We have no money; it has all been spent on small-holdings,' which, I think, we are all agreed are economically unsound. Small-holdings and forestry may go together in certain districts, providing a living for men, but not agriculture or small-holdings by themselves. The two ought to go together. They may work together, and they are not antagonistic, but they should not be under the control of the same body. A body of men who may be quite good for agriculture would be absolutely helpless in controlling a forestry system for the United Kingdom. I have much pleasure in asking the meeting to adopt this resolution, and in seconding Mr Richardson's motion."

Mr E. P. Stebbing.—"The second clause of the Resolution reads 'of freeing the local administration in Scotland from the subservience to agricultural administration,' etc. To mention two large countries where forestry plays an important part in the economy of the nation, America and India, it is noticeable that forestry forms one of the branches under the Secretary for Agriculture. The following extracts from the report of Mr Wilson, Secretary for Agriculture in America (which I had occasion to review soon after it appeared), published a little over a decade ago, are perhaps to the point:—The report reviewed the work of the Department of the preceding eight years, during the whole of which period Mr Wilson had held charge of the Department. During the period the appropriations from the Department had doubled though they had taken forty years to reach the figure attained at the beginning of the period under review. 'This money had been spent,' says Mr Wilson, 'in the promotion of agriculture, using the term in its widest sense.' Mr Wilson estimated the wealth of production on farms at the end of the period (12 years ago) at £1,283,000,000, 'the highest amount yet attained by the farmer of this or any other country, a stupendous aggregate of results of brain, muscle, and machine'—an increase of over 36% over the census figure of six years before. 'It was not only sufficient,' he said, 'to supply the wants of 83 million of

our own people, but last year farm products to the value of £165,000,000 were exported.' After glancing at the great increase in personnel of the Department, Mr Wilson dealt with the different branches of the Department, pointing to the development and achievements of each 'in the interests of the farmer.' Several straggling divisions had been brought under a 'Plant Industry' branch; there were the Soil Survey branch, Land Drainage branch (in both of which the Agricultural and Forest branches worked together), Animal Industry branch, Economic Entomology branch, Weather Bureau branch, and the Forestry branch. Mr Wilson did not place the forestry branch last. I have done so for convenience. 'The work in forestry,' said the Secretary, 'which has grown to a position of such recognised importance, may be said to be the product of the past eight years. At the beginning of the period the branch employed eleven persons, six filling clerical appointments. With the offer by the Department of Agriculture of practical assistance to forest owners in the management of their tracts, the field of action shifted from the desk to the woods.' And with this action and the energy with which Mr Roosevelt, the President, preached the forestry cause, the growth of public opinion on the importance of the subject was rapid. I have read these extracts to you because they point conclusively to the fact that far from forestry being divorced from agriculture in America it is closely and intimately connected with it. It forms one of the branches collected under the Secretary of Agriculture.

"At the period of which I am speaking Lord Curzon was Viceroy of India. India had a forestry branch under the Secretary of the Revenue and Agricultural Department. But no specialised agricultural branch existed. The want of such a branch was felt probably as much by the forestry branch as by any other since, in its absence, it proved next to impossible for forest officers to get into touch with agriculture, a good deal of unnecessary friction, avoidable under other conditions, being the result. It was Lord Curzon who put his finger on this weak spot, one of the numerous instances in which that great viceroy exhibited his unerring judgment. He formed the specialised agricultural branch under the Secretary of the Department of Agriculture, and in his speeches during the period of his viceroyalty he bore witness to the intimate

connection between agriculture and forestry. You will note the curious parallel. In America the agricultural branch existed under the Secretary for Agriculture, but there was no forestry branch. During the same period in India there was a forestry branch but no specialised agricultural one. In both countries the two absent branches came into being at about the same time. But in each case there was no difference of opinion as to the department they should be included under.

"We have, therefore, as an example to us, two of the greatest agricultural countries in the world, in both of which forestry forms a branch under the Secretary for Agriculture thus assuring that these two important industries, which are so intimately connected and dependent upon each other, should work hand in hand. Should we not consider this evidence good enough? Remember if we make a mistake now we shall put back the cause of forestry by decades."

Mr Menmuir, Edinburgh.—"I would like to alter the resolution. Instead of having 'placing the Central Control of Forest Policy under men conversant with the subject,' I think it would be better if it read, 'placing the Central Control of Forest Policy in Scotland under men conversant with the science and art of Forestry.' There is a great difference between a man who knows the scientific or theoretical aspect of forestry and one who is acquainted with the practical side of the subject, and I think the expression 'conversant with the subject' does not very well carry out the idea of the Society, because a man may consider he is conversant with the subject and may be only a theorist in forestry. I think this Control Board should be made up of men thoroughly conversant with the whole subject of forestry, both theoretical and practical, and considering what was said in Parliament on Saturday in regard to the governing of the different countries, I think it would be for our benefit to put 'in Scotland' in, because there is no doubt that this idea of managing our internal affairs ourselves is a question of practical politics."

The Chairman (the Duke of Buccleuch).—"Do you move an amendment?"

Mr Menmuir.—"Well, I might put that in as an amendment —To leave out the clause marked (1) in paragraph 2 of the resolution, and to substitute 'of placing the Central Control of

Forest Policy in Scotland under men conversant with the science and art of Forestry.'"

Mr Drennan.—"I have much pleasure in seconding that."

Mr H. M. Cadell.—"Would it not be better English to say, 'Men with a practical and theoretical knowledge of the subject'?"

Mr Menmuir.—"It is all the same."

The amendment was supported by three members, and was declared lost by a large majority.

The Chairman.—"This resolution, which was submitted by the Arrangements Committee, has been put before you very ably by the mover and seconder. I think there is one point which was quite rightly left out of the resolution, but which we must consider, and which to my mind, once we get a working body on forestry started, is the most important question of all, that is, the financial side. Whatever may be done as regards having a good body to advise and control forestry, it is quite certain, as regards private enterprise at any rate, that you will never get planting on a scale in any way commensurate with the interests of the country unless it can be shown that those who are going to plant as a private enterprise have some prospect of getting a reasonable return. In all our discussions afterwards that must be kept in the forefront. I do not mean to say I am against State afforestation at all, but it would be a very great mistake if anything is done which may practically prohibit any private afforestation, especially as we all know the State at the present time has no staff sufficient to cope with the subject. It would require a very highly skilled staff of course. It would take a considerable number of years to organise and develop that staff, and those years would be lost during which we might get a very great advantage even from the mistakes of private planters. I have ventured to bring this forward in an article on the taxation of woodlands, which I admit is not particularly well written and does not do justice to the subject, which will appear in the forthcoming number of the *Transactions*. I would ask members to be kind enough to read that article. I have written it chiefly that this question may be considered. I feel that the amount of burdens and taxation on woodlands and timber at the present time is unfair and unjust, and is far and away higher than on any other form of property or industry in this country; but the real point is this, whether just or unjust it is so prohibitive that

it is bound to stop planting by private enterprise, and that is a serious thing, because all who have studied the question agree that it is essential to the independence, you may say, of the future of our country that we must have our timber supplies largely augmented. I do wish that all those who take an interest in afforestation would look into this question of finance. It is a question, I am sorry to say, that has been rather burked in the past, because it is an unpleasant one and very difficult to meet, but we must face it. Now that the cost of labour is much greater, that taxation is higher, and the rate of interest on money also higher, planting is more out of the question than it was before the war.

"As regards the remarks made about agriculture and forestry, it is very obvious if there was any antagonism between the two interests I would hardly be sitting in the chair here to-day. Agriculture, of course, is the paramount industry for the land. That we all admit, but I think everyone who has studied the question, but especially those most largely interested in agriculture, have come to the same conclusion as the proposer and seconder—that there is no antagonism between agriculture and forestry. Properly worked, there is considerable advantage to agriculture in forestry, and as regards land which is fit for cultivation being planted, there may be a bit here and there, but I think we may safely say that, taken on general grounds, it is not contemplated unless by either a lunatic or an idiot. The two can be worked together, and while we have got in this country to have food for our existence, there are other things as well, and one of these is timber."

Mr Stebbing.—"What is going to be done with this resolution when it is passed?"

The Chairman.—"It will be sent to Lord Curzon and Mr Barnes."

The Secretary.—"We have been in the habit of sending our resolutions to the Cabinet, but we shall send this to the Sub-Committee of the Cabinet dealing with forestry, the Prime Minister, the Minister of Reconstruction, the Secretary for Scotland, the Development Commissioners, and the Board of Agriculture."

Mr Stebbing.—"I understand, so far as the Sub-Committee goes, Lord Curzon and Mr Barnes were not appointed to enquire afresh into the whole question of afforestation, but simply to

advise the Cabinet as between two rival schemes, that, in other words, they have these two schemes in front of them, and I do not see why this Society should put itself in a rather invidious position by approaching this Sub-Committee again when they have got the two schemes before them. This, I may say, I have had from Lord Curzon himself. I understand they do not want any more material in front of them."

Mr Richardson.—"I do not think we have any knowledge of these rival schemes."

The Chairman.—"Mr Stebbing may be in the confidence of the War Cabinet, but we are not. As I understand it, Lord Curzon and Mr Barnes have a very important question to deal with, and naturally they will want all the information before them. However, whether they do or not, we do not know officially, and the question now is——"

Mr Stebbing.—"I am prepared to submit the letter that I have referred to."

The Chairman.—"Will you kindly allow me to proceed? I do not know about this. As a matter of fact, I wrote Lord Curzon myself, and he answered my letter. However, it had nothing to do with this question here."

The resolution was adopted by 45 votes to 3.

The Secretary.—"The resolution will be sent to the Sub-Committee of the Cabinet (Lord Curzon and Mr Barnes), the Prime Minister, the Minister of Reconstruction, the Development Commissioners, the Board of Agriculture, and any others the meeting may wish it to be sent to."

Sir Hugh Shaw-Stewart.—"I move that it also be sent to the Scottish Members of Parliament."

Sir James Campbell seconded, and this was agreed to.

Education.

The Secretary then read the following report of the Education Committee of the Council, and explained that it was submitted to the meeting with the object of enabling members to express their views and to submit suggestions upon the subject:—

The Education Committee met in 19 Castle Street, Edinburgh, on 26th June 1918, to consider the remit made to them by the Council on 11th May last. There were present Sir John Stirling-Maxwell, Dr Borthwick (convener), and Messrs Allan,

Richardson, and Leslie. Dr Borthwick occupied the chair, and it was agreed that he should meantime continue to act as convener.

Letters of apology from the following were read:—Messrs Annand, Davidson, Whitton, Macdonald, and Hamilton.

The Committee then proceeded to deal with the remit.

1. "*Introduction to Forestry.*"

The Committee were of opinion that a new impression of 1000 copies of this little book should be obtained if the cost was reasonable. They instructed the Secretary to send two copies of the book to the Cabinet Committee in charge of afforestation, and to mention that 4000 copies had already been distributed and that a further impression of 1000 copies had been called for.

2. *University Schemes.*

The Committee were of opinion that the courses of instruction proposed for the Diploma and Certificate of Forestry at the University of Edinburgh were much too superficial for forestry purposes, but that they might be useful to men who proposed to take up rubber-planting. They thought that it would be a misfortune if these courses were understood to be suitable for foresters. The Committee were further of opinion that university education was meantime well provided for, but that there was a lack of students, occasioned no doubt by the absence of suitable appointments for them on obtaining their degree. The Committee thought that the Universities should confine themselves to their courses for the degree of B.Sc., and that the Agricultural colleges should be left to deal with Diploma courses for practical foresters.

3. *West of Scotland College.*

A memorandum by Mr Gordon was read, in which he dealt with the Diploma, Certificate, and other courses.

4. *North of Scotland College.*

Mr Leslie explained the position with regard to this College, and said that Diploma and Certificate courses were in contemplation.

5. *East of Scotland College.*

The proposals with regard to the institution of a Diploma course in this college were submitted and considered. It was considered that General Physics should have a place along with Chemistry in the first year's course of instruction, and that practical woodwork might be omitted. Timber conversion should come in under Forest Utilisation in the second winter. It was also recommended that before the diploma is granted to a student he should have had not less than three years' practical training in forestry, and that the first of these years should be over before beginning the course and the other two years before the diploma is actually granted. It was also recommended that the practical training should be described as "approved training in practical forestry," instead of "on an approved estate."

The Committee was strongly of opinion that a Certificate course is unnecessary, and that a uniform or similar Diploma course should be established in all the colleges.

6. *Birnam School of Practical Forestry.*

The Committee welcomed this scheme, but expressed regret that there was no intention meantime to train young men under military age who were apprentice foresters on equal terms with soldiers and sailors. They were of opinion that the provision being made was not adequate to the circumstances, and that the scheme should be extended so that a larger number of men could be dealt with and a substantial number of trained men be made available for carrying out schemes of afforestation.

They also expressed the hope that the teaching would be efficient, as the success of the school will depend so largely upon the man in charge and on his influence on the students.

Sir James Campbell.—"I have not had the benefit of seeing this minute and have only heard it read this moment, but I take it that it recommends diplomas to be granted by Colleges of Agriculture and not by Universities. I should not like to commit myself, or the Body I have the honour to represent, to this view. We in Aberdeen have special relations with the University, and so far as I can gauge the feeling of the College in Aberdeen they would prefer that diplomas would be granted by the University. Personally, I think the diplomas would

have a higher standard and carry more weight if they were granted by the University. We may be in special circumstances, because in Aberdeen we own an estate in which there are over 200 acres of woodland capable of carrying all kinds of trees and providing special facilities for training foresters if we were only allowed to proceed. I therefore do not at present see my way to agree to that clause in this minute, as representing the North of Scotland College of Agriculture and also the Aberdeen Branch of this Society."

Mr Allan.—"I think the degree of B.Sc., which is granted by the University at present, was for a class of men who have a much higher education than those who would go in for the ordinary college diploma. A great many foresters would like to go further and secure the diploma which would give a distinguishing mark to them, but they could not pass the University Preliminary Examination, and therefore they would not be able to get the diploma if the University granted it. So we recommend that the Universities continue to give their course and grant the B.Sc. in Forestry, but that the various colleges give a course and grant the diploma to foresters who have not got sufficient education to go forward for the University Preliminary."

Mr Menmuir.—"I think the last speaker has said what is absolutely necessary in regard to forestry education. The University is all very well for the B.Sc. degree, but the agricultural colleges are the proper bodies to give the diploma in forestry. There is no doubt about that. It is a mistake for us to imagine that the Universities can do this work. They are more for general training in other things, but the agricultural colleges should be looked to as being the seat of learning in forestry. In regard to the training of the forester, I would propose that a young man gets three years' practical training before he goes to college, because if he has only one year's practical training and then goes to college for two years' theoretical teaching, he would likely want to come out more as a lecturer. Moreover, we know that in any calling a man wants to be a certain number of years at it to get it thoroughly fixed in his mind and develop the power of concentration, and one twelve-month only and then theoretical training at the college would not be sufficient. I therefore recommend that three years ought to be spent by a young man in practical

work, and then if he wishes to take up the theoretical aspect of it he can go to the college for it."

Mr Allan.—"That was one point I did not mention. In the report of the Committee we do not say that they are only to have one year, but one year at least. They may take the whole three years before they go and take the diploma, but we thought it better to leave a little latitude because circumstances might not be always the same."

Sir Hugh Shaw-Stewart.—"I would like to be assured, and I daresay Dr Borthwick can give the information with regard to the diploma proposed to be granted by the colleges, that the examinations at the different colleges will be practically uniform. I suppose we can be sure of that."

Dr Borthwick.—"They would be made as similar as possible. As regards the practical training of the young forester, if three years is insisted upon before he begins his training, then it might mean that the practical work would have to start pretty early. Suppose he starts at 14 or 15, by the time he was 17 or 18 he might go in for his first class at the college, but if you insisted on three years previous to the college you probably would start him rather early on forestry work, before he can make real use of it as a forestry apprentice, although the sooner he begins the better. Three years is a fairly long time in a young man's training for a career, and if that is to come before the training in the college it might frighten him, but if he can put in a year or so of technical training combined with practical instruction during those three years, or following them, it would be much easier for him to take advantage of such a course."

Mr Richardson.—"The point is this, before a man can get a diploma he must have had three years' practical forestry, one year of which must be before he entered on the course at all."

The Chairman.—"I do not think there is anything between you."

Mr Menmuir.—"I have known young men, who perhaps have had a twelve-month at ordinary work, go to the college for a year or two and get a distaste for doing ordinary manual work. They would rather prefer to be paid for watching other people working, consequently, seeing there are so many people like that, they cannot all get employment."

Sir James Campbell.—"I have just one word of explanation.

One of the gentlemen who spoke seemed to think that the Universities only were to have power to grant degrees. We in Aberdeen have already a degree in forestry. We have two lecturers in forestry, one appointed by the College of Agriculture and one by the University. We are in exceptionally close touch with the University in all our forestry work, and, as I have already stated, we have an admirable estate close by for the valuable purpose of training foresters in practical work. We do not assume that the diploma to be granted will be of the same standard as the University degree in Forestry, and I should be sorry if there was any misapprehension on that point. I desire simply to enter a caveat that, personally, I do not adopt or commit those I have the honour to represent to the adoption of the view put forward in the minute."

Mr George Leven.—"I think an important omission has been made by the Committee. I am extremely disappointed that they have made no reference to the training of women. At this moment, when we are extremely short in so many branches of labour, I am glad to be able to say that I am much more than a convert to women's work in forestry. At the present moment I could specify one estate in the south-east of Scotland—not the one I am connected with—where women have undertaken very important work during this past season. They have not only been useful in planting operations and in felling and cleaning pit-wood, but they have tackled trees of a cubic capacity of 230 feet and felled them to the satisfaction of merchants and others. That is a very big undertaking, and there are many people who would scarcely believe it, but it is absolutely the case, and I believe if we could devote more attention than we have done in the past to better tools, better equipment, and perhaps a little better accommodation than some of them have had, that we would be able to make use of a very great number of women. I do not think it is altogether fair that we should treat them as beasts of burden. We should make some provision for training them, because I am absolutely convinced they can do a great amount of the work that falls to men in forestry. The women I have referred to have been able to do almost all the work with the exception of "laying in" these very large trees. They should be well equipped as regards dress and improved tools; and I think when they are provided with proper saws and other instruments to work with to suit

their conditions that they are able to do very fine work, and I think this Education Committee ought to consider whether it is not yet possible to do something in the way of giving women a course of training.

"The training of discharged soldiers is in the hands of the Board of Agriculture at present. I do not know the inner workings of that Board, but I am absolutely convinced that they are not going on the right lines. At the present moment I know a little about the training of these men, and I am glad to say they are doing remarkably good work. Some of these men have gone through the brunt of battle, and they ought to be carefully looked after and encouraged. I do not think at the moment they are being encouraged as they ought to be. I may tell you of an instance that I am acquainted with, where these men who have come home disfigured and disabled in many ways are still capable of doing a great amount of work, and at the present moment they are being paid at the rate of 27s. 6d. a week. They are doing work which, if it is not altogether up to the standard of the ordinary forest workman, really should be encouraged, and I think the Board should consider, if they want to interest these men in the work, whether they ought not to do something more for them than they have done. Unfortunately, on the forms they have to sign every week, there is a proviso that any allowance that is made shall be deducted from their pensions. If we are going to encourage these fellows and bring them into forestry and do what we can to interest them in it, there will have to be something more done even in the initial stages. They were promised lectures and other means of improving and instructing themselves during the time of training. So far as I am aware, there has been no attempt made to do anything of the kind, and I think the Committee ought to see that these men are encouraged and helped."

Sir Kenneth Mackenzie.—"I find it extremely difficult to hear what is being said in this room, and in a report so important as that of the Education Committee I personally have been quite unable to take in all they have recommended. I think this question of education is one of the things we have to face up to, and I would like to suggest that a further discussion of this subject might take place at another meeting, and that before that meeting we should have the advantage of the

report of the Committee in our hands, which we could study before we come to the meeting."

Mr Richardson.—"I think Mr Leven is under a misapprehension with regard to the training of the ladies in the report. We merely mention apprentices. They may be either male or female."

The Chairman.—"You mean the Education Report includes ladies, although it does not say so?"

Mr Richardson.—"I think so. There is nothing to prevent ladies going through the apprenticeship like men."

The Chairman.—"I see the expression in the report, 'training young men.'"

Mr Richardson.—"It would meet Mr Leven's case if the words were altered to 'forest apprentices.'"

The Chairman.—"It is only a general discussion we are having, and there is no resolution actually proposed. The report was practically adjusted only this morning, and was really brought here for a general discussion, in order to get at the views of the meeting, which undoubtedly would be a help to the Committee afterwards. The proposal has been made by Sir Kenneth Mackenzie that this question should be brought up at some future meeting."

Mr Stebbing.—"Could the report be circulated, and then we could send in any suggestions we thought might be of use to the Council? The thing is so long that I have not myself gathered more than a fraction of it. I do not think it is possible to take it all in."

The Chairman.—"I quite agree you cannot. I think myself the best plan would be for the Council to take this question up again. It was only brought forward here because it was thought a pity not to have a discussion, and I think the discussion has been very useful. It has raised certain new points. I think the report should be remitted back to the Council for them to take what steps they think best to elicit general opinion and put it in a suitable form for discussion at some future meeting."

This was agreed to.

2. The Society's Meeting with the Interim Forest Authority, on 26th November 1918.

The Council of the Society, by invitation, met the members of the Interim Forest Authority at 1 Queen Street, Edinburgh, in order to discuss forestry problems, on 26th November 1918. A large number of representative members of the Council were present, and the following is a report of the proceedings at the Meeting:—

Duke of Buccleuch.—"I would like to thank Mr Acland for the opportunity he has given us. I think I may say, on behalf of the Council, that I am sure the whole Society welcomes the new Board. We naturally expect great things. On their behalf I may say that we are giving you most hearty support, and will do what we can. We quite realise the great difficulties, and that every one cannot be pleased, but we feel that if a Board is constituted a great many difficulties will pass away; though the Society is not unanimous a very large majority is in favour of a Central Board, and I believe that it is the only way matters can be satisfactorily carried out."

Mr Acland.—"Thank you very much indeed for the kindness of your words. We decided as soon as we were appointed—and that was very recently—that we would ask you to be kind enough to meet us. There were dangers, so to speak, in that course, and advantages. Having been appointed so very recently, and having at once come to Scotland and asked you to meet us, we are not in the position of having formulated anything like a hard-and-fast policy, nor have we the staff and equipment to carry out the policy. Therefore you will find, I am afraid, that we are not able to give definite assurances, definite answers to some of the questions you will naturally put to us. On the other hand, it would have been discourteous on our part if we had waited to see you till a considerably later date, and we might have found, to our mutual regret, that we, lacking that contact with you, had got into definite lines and policy which we should have modified if we had had the advantage of your help, and we should have denied ourselves the real help and encouragement which I know we shall now have from getting into personal relations with you. You will, I know, understand the difficulty of our position. It has seemed

good to the Government to set up this body, an Interim Forest Authority, to make certain preliminary arrangements for the development of afforestation in the United Kingdom, and I should like to say that we have with us to-day representatives of all parts of the United Kingdom except Wales. Mr Davies is not here, but we have Mr Ponsonby from Ireland, Lord Clinton, Lord Lovat, Colonel Fothringham, and Mr R. L. Robinson. But we have been set up merely as an Interim Authority, having a certain sum of money only secured to 31st March, though we have assurances that we shall have further funds after that date. There is no certainty as to the form which legislation will take, but until legislation is passed we are instructed to work in close touch with existing Departments. But clearly as an interim body, and without any certainty that we shall pass into a permanent body, we shall not be able to say things so definitely as if we were permanent. We expect legislation next year, but we can have no certainty about it. It seems to all of us, however, one of our most important duties to give help in the restoration of our reserves of timber, not only in Scotland but in the other parts of the United Kingdom, and in spite of our limitations we hope to get this work really started. I am very glad you have been kind enough to come, and I am sure that we shall be able, if I may say so, to work together for good if you will talk to us in the most candid way about what you would like us to do.

"I have been given a sketch of procedure. I roughed out half-a dozen headings under which you might desire to talk to us, and I find that under the heading about re-planting Mr Leslie and Mr Macdonald will speak on behalf of the Society."

Mr Leslie.—"Mr Macdonald and I have been asked to express our views as to what efforts proprietors are likely to make in order to secure the reafforestation of the lands on their estates suitable for growing timber, and I can testify that, so far as the North of Scotland is concerned, there is abundant and gratifying evidence that proprietors have made up their minds to begin planting operations on a scale commensurate with their financial ability as soon as there is a sufficient supply of labour available for the purpose. Even if no steps were taken by the Government to promote afforestation, I am convinced that the stimulat-

ing effect the war has had would result in large areas of land being stocked with timber, but I am equally confident that the results will not be permanent nor enduring unless the movement is carefully fostered and assisted by the State. The report of the Forestry Sub-Committee has, I believe, been carefully studied by the majority of north country landowners, and the impression I have received is that the salient features have met with their approval.

"A number of proprietors—a much larger number, I might say, than I had expected—have informed me that they are prepared to plant the whole of the afforestable land on their estates at their own expense, and to follow any lead that may be given them in this direction by the State. All that they need is the assurance that the State is in earnest in regard to the business, and that they are really wanted to grow timber. They would be prepared to carry out the planting operations in accordance with any scheme which might be prepared in consultation with the State forest officers, and, although receiving no assistance from the State, would be willing to place their woods voluntarily under State supervision, paying all the costs of planting and the incidental expenses themselves. Other proprietors have informed me that they are, unfortunately, not in a position to undertake the planting of more than a proportion of the woodland areas on their estates, and could only plant the remainder if they were to receive assistance from the State. One proprietor whom I could mention said that his position was that he would be able to maintain under forest all the land which was now stocked with timber on his estate, but could not plant much more. If, however, he were to receive assistance from the State, say, in the shape of a grant of £2 per acre planted, he would be prepared to extend the forest area by over 1000 acres. Another proprietor informed me that he intended planting 30 to 50 acres per annum if the work had to be undertaken solely at his own expense, but in the event of his receiving the £2 grant he would be prepared to double or treble the annual planting area. A third class of proprietor is the proprietor whose lands are burdened to such an extent that he has no money available for planting, and from discussions which I have had with proprietors who are in this position, I have formed the opinion that their case could often be satisfactorily

met by allowing them the grant of £2 per acre, with a loan of £3, 10s. to cover the balance of the expenditure, as suggested in the report. I have given these instances merely for the purpose of showing that proprietors have been giving careful consideration to the proposals outlined in the Forestry Sub-Committee's report, and that they are prepared to go ahead as energetically as circumstances permit. The proprietors to whom my remarks apply are chiefly the owners of large estates with areas of woodlands sufficiently large to require the services of a skilled forester, but there are also throughout the North of Scotland numerous small estates with woods not exceeding 200 to 300 acres. On such estates no skilled forester is, as a rule, employed, and the proprietor and the estate workmen are often very ignorant as to how the woods should be dealt with. During the last two or three years I have had frequent opportunities of forming an opinion as to the needs and requirements of small estates. My services have been constantly in request with small proprietors wishing to have advice as to how the woods should be marketed, and such invitations are generally followed by requests for advice regarding replanting. Most of the smaller proprietors would be eager and willing to participate in the work of afforestation."

Mr Acland.—"Are they mainly people who have sold timber during the war?"

Mr Leslie.—"Yes. As an illustration of what is taking place even now, I might say that during the last few weeks I have had on an average two or three requests per week from small proprietors for advice as to how to market their woods. The timber would probably be worth on the average from £3000 to £7000 on these estates. Unfortunately the staff of Advisory Officers is at present too small, and the requirements of these small proprietors cannot be studied as much as they should be, but it is urgently necessary that there should be some method found of giving them all the assistance they desire. The contribution which could be made by small estates to our timber resources might in the aggregate be very considerable, and it is often the case that the afforestable land on small estates is suitable for growing timber of very high quality.

"I have also been making inquiries with a view to ascertaining whether proprietors might be willing to go in for the proceeds-

sharing scheme or some of the leasing schemes, but I find that the grant of £2 per acre seems to be the most popular type of scheme. Most of the proprietors with whom I have had discussions on the subject are desirous of carrying out the work themselves, and what is wanted from the State is chiefly financial assistance in the shape of grants towards the cost of planting. I have no doubt, however, that there are certain districts where the proceeds-sharing scheme would be the most suitable type to be put into operation.

"I see that Mr Macdonald and I have also been asked to refer to the rabbit and squirrel question. Economic forestry is quite impossible unless rabbits are thoroughly kept down. Most of the proprietors who have informed me that they are going in for extensive planting operations have decided that it will be necessary to employ trappers to keep down the rabbits, but it would be useless to trap rabbits if they were not at the same time prevented from coming in from neighbouring estates. I think the rabbit question should be taken up by the Forest Authority. As to squirrel damage, I think it can be said that most of our middle-aged woods in the North of Scotland have suffered severely from squirrels. I have rarely seen a plantation where squirrel damage has not been evident. The Forest Authority should also take up the question of how to have the squirrel exterminated."

Mr Macdonald.—"My experience after visiting the wooded areas in the East of Scotland bears out pretty much what Mr Leslie has found. During the last four years, I have come in contact with a large proportion of the landowners in the East of Scotland College area, and in every instance I have found that they are most anxious to plant; not only do they wish to replant those areas which have been recently felled, but they seem anxious to increase, and increase very largely, their plantable areas. In the East of Scotland I think I am safe in saying that the estates, as a rule, are on a much smaller scale than some of those in the north, and all along I have found that the principal difficulty with these proprietors is the want of practical advice. These estates are so small that they cannot really afford to pay a first-class forester. They are willing to plant, but do not know how to go about it. They do not know the species of trees that suit different soils, how to group the

suitable trees, and are very much handicapped in that way. Of course the various colleges, through the Scottish Board of Agriculture, have tried to remedy this to a great extent, and many of the proprietors have expressed their appreciation of what has been done in this way. But, as Mr Leslie has said, this is scarcely enough, and Advisory Officers have not sufficient time at present to go over all these places so as to advise the number of proprietors who are anxious to get their services. We are practically half-time men, and if our time were entirely taken up with that work there would still be a lot to do. And again, in the east, as all over Scotland, there is this question of rabbits. It has been serious at other times, but never so serious as at this time. With the present cost of fencing material, it is practically hopeless to attempt to enclose all the land to be planted. Unless some compulsory measures are taken to exterminate these pests, I do not see how it can be done. It is all very well for one proprietor to do his best, but so long as his neighbour across the fence takes no trouble at all, the whole thing is hopeless. There should be compulsory measures that would compel all proprietors to keep rabbits down.

"The same statement is true of squirrels. In the North of Scotland proprietors have for years taken precautions to destroy these pests, but again there are others who take no interest, and so the thing goes on.

"Again, there is the burning of brushwood, which at the present time covers a very large proportion of the plantable areas of Scotland, and this is a much more important thing at this moment than the planting of trees. Unless the ground is thoroughly cleaned, it is no use spending money in planting to have the trees destroyed within twelve months. One can easily see, in walking through the country just now, that a very large proportion of the middle-aged and younger plantations, especially Scots pine, have been very seriously damaged by the pine beetle, extraordinary damage being done. It is very important that this matter should be taken up at once, and that the whole area should be cleaned before any serious planting takes place."

Mr Acland.—"The points which have impressed me most in what Mr Leslie and Mr Macdonald have said are, first of all, that there is in many cases a considerable willingness to re-

plant, and that in many cases the fact that the State is able to help, even by a grant which bears so small a proportion to the total cost in present circumstances or in the future even, will make a considerable difference in the case of some persons; and that the small proprietors particularly are willing to do their best, but are very much in need of having at their disposal the services of Advisory Officers. These should, I think, be full-time officers, devoting all their energy to that work. We have heard also that a great deal depends on having powers which are not at present possessed under the law of dealing with rabbits. So far as we have gone into it at present, we entirely agree that a Forestry Bill would not be complete unless there were proper clauses in it dealing with the matter. Powers would be set up requiring persons from whose lands rabbits might come either to exterminate their rabbits or, if it can be done, securely to fence the areas. Something of that kind will have to be done. Then there is the difficulty of fencing material; we know it is a real difficulty at the present time.

"As to the last point, we realise that it is often necessary, in regard to parts where felling has taken place, to do a great deal in clearing up brushwood before planting, so that it may be free from attacks of the beetle, etc."

Duke of Buccleuch.—"We have had a very large access of members to the Arboricultural Society."

Mr Acland.—"How many new members?"

Mr Galloway.—"Two hundred and five elected at last meeting; between 50 and 100 applications for next meeting. Total membership, 1500."

Mr Acland.—"My colleagues and I realise that, so far as our present money goes, we must be willing from the very start to assist people to replant, and it is only a question of making proper inquiries, as, I think, any authority would require to do. We ought to be willing to consider proposals to plant, and to examine these proposals, and, if they are approved, enter into definite obligations to give assistance."

Mr Whitton drew attention to the damage done by black game to woods, especially in the West of Scotland.

Mr Duthie.—"With regard to the supplies of tree seeds and seedlings, on which I have been asked to make a few remarks, I shall confine myself first to the forest seeds that can be

obtained wholly or partly at home, and secondly to those that require to be imported.

"*Home-Grown Supplies—this year.*

Ash Sycamore	An abundant supply.
Beech Oak Spanish Chestnut	A very light crop. Heavy sowings of beech made last season.
Douglas Fir Scottish Larch	A good crop, but not sufficient to cover our normal sowings.
Scots Pine	One of the poorest crops on record, following a light crop last year; comparatively few cones have been carried over.

"Scots pine of continental origin are so liable to the leaf-shedding fungus that neither seed nor plants ought to be imported, thus every endeavour should be made to collect all the native seed possible. I am glad to say that there is every indication of a bumper crop next year.

"*Seeds to be Imported.*

Silver Fir Norway Spruce Corsican Pine Larch, from the Swiss frontier	Of excellent quality. Can be obtained in France.
Japanese Larch	Is reported a good crop in Japan.
Douglas Fir Sitka Spruce	Average supplies are available in U.S.A.

"I think, therefore, that I am justified in assuming that ample supplies of coniferous tree seeds, except Scots pine, will be available for sowing next spring, provided early arrangements are made for their transport from France, and more particularly from America.

"Last spring the delays experienced in getting delivery were, to say the least of it, heart-breaking, and few people were able to obtain delivery of imported seeds before the end of April.

"It is sincerely to be hoped that pressure can be brought to bear on the Ministry of Shipping to facilitate the speedy shipment of all parcels of tree seeds coming from abroad.

"Before leaving the subject of tree seeds I would like, in a word, to urge the necessity of utilising to a far larger extent than formerly our native supplies of tree seeds. It is almost superfluous to add that home-saved seeds invariably produce stronger and more robust seedlings less liable to frost damage than plants raised from imported seed. A case in point is the extraordinary growth made by Japanese larch grown from home-saved seed as compared with plants raised from Japanese seed, also a vigorous grower.

"*Seedlings.*—The present stock of seedlings in Scottish nurseries is, I am afraid, very low, probably one quarter normal. This shortage is due to two causes—lack of demand during the planting seasons 1914-17, and shortage of labour. In the autumn of 1914 both trade and estate nurseries were splendidly stocked, and it is a lamentable fact that a very large proportion of this stock had to be subsequently scrapped when it became of an age and size to be too large for ordinary planting.

"Nurserymen, I believe, are now prepared to grow larger stocks than ever they have done, but it would be helpful in more ways than one if the Authority or Authorities controlling forestry gave some indication, not a month or two but a year or two in advance, what species ought to be grown, and they would only be too glad to get rid of the irregular and intermittent demand which made the gauging of prospective demands so unsatisfactory.

"If larger sowings are desired next spring, it will be necessary to release at the earliest possible date some at least of the skilled men presently on military service.

"Although I have no mandate to speak for Scottish nurserymen I believe I am justified in stating that, given time and labour the existing forest tree nurseries are perfectly capable of meeting every demand that may be made upon them.

"To be more definite, I see no reason why the Scottish nurseries alone, provided labour is obtainable, should not carry by the autumn of 1920, a stock of say three hundred million seedlings."

Colonel Balfour.—"I do not know whether the new Authority intends to start nurseries for the supply of plants, but it strikes me that it would be very much more desirable, if possible, that nurserymen all over the country should do this work under some guarantee from the Authority. The nurserymen have all the

organisation for growing and packing plants, but it would be impossible for them to lay in these enormous stocks unless they were in some way guaranteed that their stocks would be disposed of for them. I think it is most important that proprietors should be circularised and their requirements ascertained, not only for one or two but for three or four years ahead. The tendency of this would be to force proprietors to study out their planting schemes beforehand, and make it possible to have adequate supplies of plants. Hitherto it has been far too much a hand-to-mouth business, the proprietor having no definite scheme in his mind. It occurs to him a few months beforehand to put in 10,000 plants of this or that species, and he sends to the nurseryman for these, whereas he should have made up his mind long ago, so that the nurseryman, with the assistance of your Authority, could be ready to supply him at a reasonable price with what he requires. I think it is of the utmost importance that proprietors should study out the question for themselves years beforehand.

"I think that the obtaining of seeds of trees known to be of general value for planting ought to be taken in hand by the Authority. You should have your agents in California, British Columbia, Japan, Serbia, the Caucasus and Eastern America. So far as Eastern America is concerned, the head of the Forest Service in Washington would, I know, give every assistance in his power in supplying you with the names of those who would give you reliable seeds. These when received could be handed over to the nurseryman. Of course Mr Duthie has his own organisation for obtaining seeds, but all firms may not be so fortunately placed. However, as we have heard that the supply of home-grown plants is only a quarter of the normal, it may be necessary for the next year or two, until home supplies are adequate, to find out what the nurseries in Denmark, Lorraine and Sweden can supply; not Scots pine, but any other species. They presumably have large stocks of unsold plants, normally sold to Germany, which we might take advantage of if they are to be had."

Mr Acland.—"That has been extraordinarily helpful to us. The position seems to be not at all happy with regard to seeds this particular year, particularly with regard to Scots pine, and the matter needs taking up rather urgently, in order to see whether anything can be done to make the position at all better.

I would like Lord Lovat to tell us whether he concurs in the idea that we should get large supplies from France."

Lord Lovat.—"I think it would be extremely difficult I have planted 350 acres, and have promised to plant 1200 to 1300 acres this spring. I have applied for Scots pine seed to the extent of 8500 lbs., but it looks as if I was not going to get it. I think you would have difficulty in getting it, man-power being as short there as it is here. Any seed there is available we ought not to have the least difficulty about. The officer in Paris is Colonel Sutherland, who would be able to help us in this matter, as would also Colonel Graves, in America."

Mr Acland.—"We ought, I am sure, to help Mr Duthie and others who may have difficulty about permits for the importation of seeds. If we can do anything we shall be glad to do it. We shall arrange before we separate that anything of that kind should come to us."

Mr Duthie.—"There is one point about the buying of seed being centralised."

Mr Acland.—"An obvious difficulty. I agree that it would not be wise for a Central Forest Authority itself to go into the business of growing seeds, and that that should be left to nurserymen and others whose profession it is. That is obvious, and I agree. Then it is also suggested that we should make provision for the supply of these seeds. Supposing we have, later on, agents who are in touch with collectors and are getting supplies of seeds, what will be the position if the nurserymen do not wish to take over the seed at a price which will remunerate us for the price we have had to pay for it? Later on there will be competition. It will be difficult to be in a position of being responsible for seeds and yet not going into the business of supplying seeds."

Sir John Stirling-Maxwell.—"It is largely a question of notice. If notice is given in time, you would obtain supplies of seed to meet that demand."

Mr Acland.—"We could not expect nurserymen to take seeds if they could get them cheaper elsewhere."

Mr Duthie.—"Ten years ago I got through Government agency the names of all the reliable collectors in America. I have had to drop every one. They gave me Colerado Douglas for Pacific Coast Douglas, and *Picea alba* for *Picea sitchensis*. I think it was the home Authorities buying seed in London that

put the price up last year. Larch seed rose from £5 to £6 per cwt."

Mr R. L. Robinson.—"Does Mr Duthie want the buying of all seeds centralised?"

Mr Duthie.—"I would prefer to buy the seeds myself. I know what I want."

Mr Acland.—"I think the suggestion is rather that the Central Department should get into connection with honest people in different parts of the world who really are in a position to supply seeds or give information as to the supplies in different countries which should be readily available—rather than that the Central Department should go into it as a business. They should then get the help of the home nurserymen to sow that seed under a guarantee from the Central Authority that they would be relieved of the plants, and under a guarantee to the Authority that they would offer the resulting seedlings at a certain price."

Colonel Balfour.—"The price should be fixed beforehand as to what the plants should cost."

Mr Acland.—"There is rather a feeling in England that prices should not be controlled any longer than is necessary. I am not sure whether nurserymen would welcome any control."

Sir John Stirling-Maxwell.—"Is controlled price a fair description? As it is we have to pay for the thousands of plants that have to be burnt."

Mr Acland.—"I should like to reconcile Colonel Balfour's idea with Mr Duthie's."

Colonel Balfour.—"Mr Duthie is almost unique in that."

Mr Acland.—"There were one or two interesting points. Did I understand correctly from Mr Duthie that it would really be a good plan to prohibit all Scots pine seed from abroad?"

Mr Duthie.—"Yes, so far as Scotland is concerned."

Mr Acland.—"Yes, for use in Scotland. Import no seed that does not produce good results?"

Mr Duthie.—"Yes."

Mr Acland.—"I think we should be in a position to help to get men released if we had all the required particulars about them. There may be men in connection with private estates and in connection with nurseries whose early release would be of use, as the work of other men depends on them. We could communicate with Mr Galloway so that he could get particulars. The Central Authority ought to be in a position to help. But

perhaps steps have already been taken by the Board of Agriculture?"

Mr Duthie.—"Yes, there was a question in our trade paper."

Lord Clinton.—"There is a general order that all names should be sent to the Ministry of Labour."

Colonel Balfour.—"I think rabbit trappers should be included in those who ought to be released."

Lord Clinton.—"Forestry comes second or third on the list. Rabbit trappers would require to be included as forest labourers."

Colonel Balfour.—"Yes, that is what I mean."

Mr Acland.—"If there is still anything which you think the Central Forest Authority can do, of course it is up to us to do it. Does Lord Lovat confirm Mr Duthie's theory that the seed from the Swiss border does not really come from Germany?"

Mr Duthie.—"I was told on the very best authority that it does not. I made particular inquiry last year about the larch seed. It comes from the French side of the Swiss frontier."

Lord Lovat.—"There is practically no larch on the French side."

Mr Richardson.—"In regard to the training of foresters, I have been asked to speak because I had some connection with a school of forestry for practical foresters, and also for gardeners, established in the year 1892, and I may say, in connection with this, that Scotland was the pioneer country in this kind of instruction. Prior to 1892 some lectures were given, but the school was organised then, and some considerable time before the Forest of Dean School, which is pretty much on the same lines, was started. The Forest of Dean School, however, was established in a forest, whereas this was not. The course referred to was started in the Royal Botanic Garden in Edinburgh, and it was devised for practical foresters and practical gardeners. One of the conditions which was imposed on them was that before they entered the school they must have had three years of practical experience in forestry or gardening. Some of the men who entered had had longer experience than three years, but that was the minimum. The course was spread over about three years, and the men who entered it—16 foresters and 16 gardeners—were put in the place of the garden staff. They had to do the garden work, the foresters doing the work in the Botanic Garden and the Arboretum, while the gardeners were placed in the glass department, etc. The classes were held in the evening, only

sufficient being put in to enable the men to get through the work comfortably, two evenings a week. In connection with the course there was also a good library which the men could use in the evenings—a very useful adjunct to the lectures. The curriculum began with the fundamental sciences, chemistry and general physics, followed by botany, geology, entomology, land surveying and levelling, meteorology, and other subjects. Dr Nisbet and several other eminent men gave some of these lectures. The men were, of course, just paid the ordinary wages of the garden staff, and they got their education gratis. The only objection which can be urged against evening classes is that it is rather hard to try to teach tired men, but there was no indication of that in this case. As a proof that they did utilise the opportunity to the utmost, I may say that two foresters who went through these classes, Mr Annand, of Armstrong College, Newcastle, and Mr Davidson, of Edgerston, who are here to-day, went up for the Highland Society's Diploma in Forestry at the end of the course, and they were the only two students who passed with first-class certificates. There are a number of other foresters in the country—Mr Leven, of Bowmont Forest, Mr Crombie, of Longhirst, Mr Feaks, of Darnaway, Major Scott, of Scone, Mr Finlayson, of Newbattle and Monteviot, and Mr M'Millan, of Margam, and others—who passed through that course.

"I may also say in connection with this that Sir Ronald Munro Ferguson, when he was Hon. Secretary of this Society, gave bursaries to enable practical foresters to take a course at the University. These bursaries lasted for three years, and the men who were selected to take the University course were Mr Crombie, Mr Feaks, and Major Scott. The funds for the course at the Botanic Garden were supplied by the English Board of Agriculture—the Scottish Board was not established then. The Garden itself was under the administration of the Office of Works. Ultimately the grant was transferred to the Office of Works from the Board of Agriculture. It was most unfortunate that, after having been established, that course should have been allowed to lapse. Had it been continued for the twenty-six years since it was started up to this time, the country would have been well supplied with well-trained practical foresters.

"Quite recently a school for Discharged Soldiers has been started at Birnam. That is really the first school which has

been started for practical men since the Botanic Garden course was instituted. When the Board of Agriculture for Scotland asked the opinion of this Council on this scheme, we gave it our approval on condition that the school was to be open to apprentice foresters (including women) as well as soldiers. I, myself, pointed out to the Council that it was rather unfair to set up a school of this kind for discharged men and shut the door against apprentice foresters—that is, men who have not reached military age, and have had no chance to fight. But from a paragraph which appeared in the Press recently, it seems that apprentice foresters are not to be admitted at present. I understand that there is not sufficient accommodation for them. If that is the only barrier, I think it could easily be removed by an extension of the building. At any rate, it is most essential that apprentice foresters should be taken in hand at once, and that provision should be made for their receiving a thoroughly good technical training if afforestation is to make any progress at all. In connection with the Birnam School, which we suggested should include women as well as men, I would just like to say that I personally have no objection to women taking up forestry or gardening, and I have had a good deal of communication and discussion with people since the war started in connection with the employment of women in gardening. But I do not think there is very much prospect of success for women either in forestry or in gardening. I know a number of lady gardeners, and I think I only know one who would attempt to undertake all the operations connected with gardening. But she is an exception. It involves that a woman must remain single."

Mr Acland.—"I quite see that point."

Mr Richardson. — "In connection with universities and colleges, we have had before us a scheme of the Edinburgh and East of Scotland College of Agriculture, for the granting of diplomas to foresters, and we gave it as our opinion that the candidates for these diplomas must have at least three years practical training before they get the diploma, one of which they should have before they enter the College. Quite recently, in the University of Edinburgh, it has been proposed to grant a certificate and a diploma to discharged officers, a certificate for one year, and a diploma for two years' training. That is all the training they are to have. It is absurd to attempt to train men

in a subject like forestry in such a short time as that, and to send them out with a hall-mark of this sort. Forestry is a thing which requires a long training, and schemes of that kind ought to be knocked on the head."

Mr Whitton.—"I think, Mr Chairman, that Mr Richardson has covered all the ground, but perhaps I may be permitted to mention what the Corporation of Glasgow is doing. In the first place, there were 14,000 acres of which the Corporation were to plant 4000, and in the planting of that we have tried to meet the requirements for the education of young foresters in the West of Scotland Agricultural College. The first plantation, with a wide variety of trees, is merely intended as a place for a demonstration area, and also to test the suitability of those species of trees. I have a report here which is for the Committee. When I get this finished I will send a copy to show what the City of Glasgow has done. It is in rather a unique position. It is only now and again that we get conveners who take an interest in the matter. We have been very fortunate in our last two conveners. The present one is going to push on to get 2000 acres over and above the 4000 already earmarked for forestry.

"I should also like to mention the desirability of getting foresters released. Out of a staff of fourteen men who nearly all joined up, six have been killed, and we are nearly at a standstill. We have girls cutting down coppice-wood. I am very glad to say that some of the girls are doing very well. There is no heavy timber as it was all cut down eighty years ago, but I agree with Mr Richardson that girls are not physically fit for that work."

Mr Buchanan.—"I am to meet you in the afternoon, so perhaps Sir John will take my place."

Sir John Stirling-Maxwell.—"There is one point to which I should like to draw your attention. Hitherto we have been discussing practical forestry, which is very interesting, but underneath lies the question of administration, and we would like to express our opinion that it is one of your first duties to look into the question of forestry administration in Scotland. We believe that the present administration in Scotland has proved neglectful. The administration has been neglectful in regard to the fact that the Board of Agriculture have allowed forestry no participation in the funds of the Board, which, as

you know, in England and Ireland contributes largely to forestry. The Board took no steps to ascertain the position of forestry in the country before the war, and from what I have seen—having been in charge of the Timber Supply Department—it has been able to give no guidance whatever in the situation which the war has created. It has provided no training for forest officers until the report of the Forestry Sub-Committee was published, and the school now established is so small that it is not a serious attempt to meet the situation. We have been told—this summer we were told—that these schemes of afforestation were taking certain definite shapes. We have written repeatedly to the Board to ask how these schemes are progressing, and we can get no information. You will most likely have been told that there were quantities of schemes under consideration, but, so far as we know, no scheme has been adopted. That matter requires very careful inquiry. All we know is that not a single scheme has yet matured.

"I would particularly ask you to inquire into two schemes, one in regard to planting of ground at Craigmyle, and another in regard to planting of ground at Fort Augustus, which I think was offered by Lord Lovat. In the case of Craigmyle we understand a scheme was adopted by the Board, and every opportunity was taken of advertising it. Even the Courts of Law were pressed into the service as advertising agents. Arrangements were made for the taking over of that ground, which have been kept a mystery. I understand that the agent who brought that scheme to the notice of the Board was a member of the Development Commission. It would be interesting to inquire whether the terms which were arranged for Craigmyle have been offered for any other scheme. Also, on whose authority the scheme at Fort Augustus was turned down, as it was, in a hostile report.

"These are disagreeable matters. I am sorry to have to call your attention to them. We shall require to have a reasonable administration before we have progress here. It is up to the new Authority to make sure that we do have a good administration in Scotland. None of us care to make trouble, and if the administration can be put right by your good offices, we shall be only too glad that the thing should be done quietly, but if you cannot put it right it cannot be left as it is. We

think it will be your duty to denounce it to the War Cabinet, and, if necessary, to Parliament.

Mr Acland.—"The last thing that the Authority wants, of course, is to take a partisan view. But I entirely agree with what Sir John Stirling-Maxwell says as to the facts. It really is our duty to go into the facts very fully indeed, not merely to listen to what is told us, but to form conclusions from the facts themselves. That is, of course, what we ought to do, and shall try to do.

"There is no doubt whatever that, first of all, it is our duty, according to the terms on which we are set up, if the Board of Agriculture desire to continue the work in forestry, to work with them *ad interim* until legislation is passed. We have already satisfied ourselves beyond any possibility of doubt that if the Forestry Department of the Scottish Board is to be made an efficient administration for forestry, it has to be enormously strengthened and developed. There is absolutely not in existence a proper Forestry Department now. There is no doubt about that. The Board at present has not a sufficient number of trained or expert persons to do the work. In saying that I do not wish to cast any reflections at all.

"With regard to the schemes of replanting, acquisition of land, setting up schools, advisory work on private estates, and survey work, these should be started on a big scale, if the Authority is worth setting up at all. The Board of Agriculture does not pretend to be organised to be able to tackle them. We shall have to work through the Board at present, and no doubt, so long as we do so, a department of the Board will act as the Executive Department for Scotland. I think that must mean a very great strengthening, a very great expansion of their work, and we shall be able to assist from our funds.

"In the programme supplied there is a heading on the nature of the Permanent Authority to be set up. That is a little in the nature of prophecy. We cannot say what the Permanent Authority will do, but I know it is the view of my colleagues on the Interim Authority that they themselves ought not to do the Executive work. They ought to keep the body and its staff small. Really the great bulk of the work should be done in Scotland by a purely Scottish Executive, manned by Scottish officers, and the Central Forest Authority should only supervise in order to be certain that the same lines

of policy are being carried out in the different parts of the United Kingdom. I do not think it will be necessary to centralise the bulk of the work in London or anything of that kind, but rather we should set up a strong Executive in Scotland and satisfy ourselves that it is carrying out the policy of the Authority by visits, rather than by calling all the work to come before us in London. It is intended at an early date to have an office in Edinburgh, and to have someone working in Edinburgh who will really represent the Interim Authority here.

"With regard to training, we have realised from Mr Richardson's speech that anything with regard to the training of officers is a slow and deliberate business, but I think I take it from him that it is probably necessary to provide in the near future in Scotland for considerably more opportunity for training of foresters, and that probably private proprietors and others will be wanting in the fairly near future a larger supply of trained foresters than there is anything like certainty of producing. Do I take it that we could probably multiply the school at Birnam three or four times over without any chance of flooding the market with people who will find it difficult to get employment after the period of training? You approve of the Birnam School, but you think that more in that direction should be done?"

Mr Richardson.—"Yes."

Mr Acland.—"You think two years at a school as well as a previous experience in connection with forestry is necessary?"

Mr Richardson.—"I am not so much concerned about the period at the school, but consider that the apprentices should have three years' practical training before they are sent out from the school."

Mr Acland.—"Ought there to be opportunities for that sort of course, not only for disabled or semi-disabled men but also for the apprentices, and, if so, would there be a supply of these young men to go through these courses if the courses are available? This was not previously the case. Do you think it would be so now?"

Mr Richardson.—"I think so."

Mr Acland.—"In England courses were started for which there were very few applicants."

Mr Richardson.—"I am judging from the school started in 1892."

Mr Acland.—"Do you include the training of forest officers or do you confine your remarks to woodmen's classes?"

Mr Richardson.—"My remarks are confined to practical foresters, though there are classes at the University for the B.Sc. I would include the Colleges of Agriculture as they are very important for practical men, more so than for superior officers who would naturally go to the University."

Mr Acland.—"Mr Whitton told us about what was happening in Glasgow, a very interesting description. We shall have closer knowledge later on when we have an opportunity of seeing the report."

Lord Lovat.—"The only suggestion I have is that we might write from time to time as to any definite information we wish to get from you. You might form a Sub-Committee to deal with these particular points, for instance, such matters as the best way of dealing with the rabbit pest and squirrels."

Mr Acland.—"We are rather appalled by the amount that has to be done. In Scotland, in a way, we have practically to begin from the very beginning. We do not find a basis on which it is possible to build a superstructure. We do not find, as in England, a considerable area of Crown woods with schools established in them, which, at any rate, provide facilities for training and research, etc., and which provide areas so that we may go ahead with planting. The whole thing has to be built up from the beginning. This meeting will, I hope, be only the first of a series of meetings with a body you could appoint to meet us. Unless we can keep full and constant and close and confidential relations established, we are likely to go on wrong lines. I do not wish this to be in the nature of one meeting only, saying we have done the right thing and then no further communication. I want this to be the first of a series of meetings of close co-operation with your body. At future meetings I hope any shortcomings may be made up."

Lord Lovat.—"Are you going to collect the names of 'key' men?"

Mr Duthie.—"The names of nursery workers have already been sent to the Board of Agriculture."

Mr Acland.—"Have we really settled about these 'pivotal' men? Have people got definite instructions to send in names? Mr Robinson, you will be in Edinburgh to-morrow. You can

settle whether we can be of any use in getting the names of men who are wanted to be released from the army."

The Duke of Buccleuch, in proposing a vote of thanks to the Forest Authority for the opportunity they had given the Society of meeting with them, said: "I think perhaps the best testimony of how much their invitation is appreciated is the number who have come here. The difficulties of travelling are so great, and a great many have come at considerable difficulty. I would certainly say we appreciate the way in which we have been received, and we are only too glad to afford any assistance in our power."

3. The Interim Forest Authority and the Training of Foresters.

The following letter has been received by the Secretary from the Interim Forest Authority. It is hoped that members will do all they can to encourage and assist in the movement for the provision of practical training in forestry as outlined in the scheme:—

INTERIM FOREST AUTHORITY,
1 WHITEHALL, S.W.1, *12th February* 1919.

SIR, — I am directed by the Interim Forest Authority to state, for the information of members of the Royal Scottish Arboricultural Society, that they are taking steps to re-open State schools for the training of woodmen and foresters in the immediate future, and also to establish fresh centres for such training in various parts of the kingdom. It is proposed to give facilities at these schools for the training of a limited number of men for employment on private estates, and the Authority would be glad to know whether members of your Society desire to nominate any candidates for admission to these schools.

Particulars of the scheme are under consideration by the Authority, and will be communicated to you at the earliest possible date, but, in the meantime, the Authority would be glad to have particulars of likely candidates for consideration. —I am, Sir, your obedient servant,

F. CHADWICK.

R. GALLOWAY, Esq.

4. History of the Plantations on Shambellie Hill, near Dumfries.

(*With Plate.*)

By Captain Wm. Stewart.

The following letter was addressed to my grand-uncle, Captain C. Stewart, by William Copland, one of a family who were foresters on this estate for at least three generations :—

Letter to Captain C. Stewart from his father's wood forester, giving an account of the planting of the Shambellie Wood.

New Abbey,
9th April 1805.

Sir,—My son received your letter dated the 27th ult., and, as desired, I now give a circumstantial detail of the wood plantations on Shambellie Hill which I assisted in executing.

In the year 1752 your grandfather enclosed 4 acres, which were planted with oak, ash and common fir, and, in 1792, I began to cut the latter from amongst the hardwood, at which time the trees measured from 5 to 20 feet of timber each. The weeding of that lot was finished in 1800 and produced about £60 per acre, besides a considerable number of small trees which were sold, when very young, at such prices as they would bring. A tolerable crop of oak is left, though not so good as might have been gained had the firs been wed out sooner from amongst them. Those which got air in time are now worth £1 each.

Five years after forming the first plantation, a second was made consisting of 2 acres of common fir, for which your father refused £200 sterling per acre, and desired me to cut and fell them to the country, according to the demand that appeared, which I am at present doing. There are 425 trees on the acre, measuring about 11 feet each, which fell at fifteen pence per foot; consequently, the value therof is £250 per acre or thereby.

A third plantation of 26 acres of common firs, with a few oak and ash trees, was executed in the year 1765 ; but the firs being too close on the ground chocked most of the hard timber. The firs are now weeding for the English market where, I am convinced, they will produce fully £100 per acre. This plantation lies on high ground.

In 1772 a fourth plantation of 28 acres was made under the direction of your father, some of which with oak and common

and larix fir, part with ash and common fir, and the rest with beech and fir. For ten years past we have been weeding the firs, which contain from 4 to 5 feet of timber in each tree and produce fully £40 per acre at the English market. The oaks which remain are worth £50 per acre. The beech is very thriving, but the ash was by no means so till cut over about three years ago, which produced an astonishing change.

During the seven succeeding years your father planted about 200 acres with oak, ash, and common and larix fir. A few of the firs are taken out which measure from 3 to 4 feet, and you know we have a tolerable good rate for them at the coal works on the English side of the water. The whole hill, which contains nearly 300 acres, was considered to be worth only £15 per annum before it was planted. I was originally tenant of part of it. The soil is mostly good and dry, though one-half of it was covered with large stones.

We generally plant from 1500 to 3000 of different sorts of trees per acre, two-thirds of which are common and larix fir, the remainder oak and ash, with some birch and alder where the ground is wet. I raised most of the plants from seed, so that your father had few to buy, and it is consistent with my knowledge that the expense of enclosing the hill and executing the several plantations did not exceed £400 altogether. I remember of our getting, in 1765, a quantity of acorns from London at the trifling expense of 40s. which produced above 150,000 plants.

Last winter your father enclosed 12 acres of more ground, on which were planted 10,000 oaks, 8000 common and 7000 larix firs, 400 elms, and 400 birches, and next winter he proposes to enclose and plant 12 acres more.

There is of natural oak wood upon the estate about 20 acres, which I have seen cut three different times in the course of the last forty years, and which has paid the family about £2000. Some of the trees contain from 26 to 50 feet of wood, and one tree, to my certain knowledge, yielded a ton of bark. I may also mention that 3 acres of common firs planted by your great-grandfather, which I cut and sold in the year 1773, produced, in several instances, not less than 40 feet of timber, being then between fifty and sixty years of age.

I have now given the particulars requested, and will be extremely happy to communicate such further information as may be necessary or in my power to give.—I am, etc.

This letter is, I think, chiefly interesting as showing the trifling cost of planting, compared with the high price of timber, towards the end of the eighteenth and the beginning of the nineteenth centuries, and also the methods of thinning and management.

From wages-receipts in my possession, it appears that a man's daily wage for planting from 1777 to 1779 was 8d. to 10d., and Scots pine seedlings cost 2s. 8d. per 1000.

I regret that I am unable to identify with any certainty the boundaries of the various plantations mentioned except the first two, and only in that case through having an estate map of 1759, which shows these two plantations. These two plantations are not now in existence, having been sold and replanted long ago, but the trees on about 40 acres of the other plantations mentioned are still standing.

In 1907 I sold about 16 acres of Scots pine which was at that time between 120 and 130 years old. The trees averaged about 40 cubic feet, and were from 90 to 100 feet high and perfectly sound, the soil being peat 2 to 3 feet deep over granite sand mixed with boulders. The price realised was 6d. per cubic foot standing, and the total value £858.

Adjoining this there is still standing about 3 acres of Scots pine mixed with a few Weymouth pine, larch and silver fir, which was evidently planted at the same date. A view of part of this clump is shown. Probably owing to being on rather better land, drier and for the most part free from peat, these trees have made a larger increment, and average about 50 cubic feet for the Scots pine, some measuring up to about 150 cubic feet.

The boles are perfectly clean, and it is interesting to note that a natural thin crop of beech has come up under all the old Scots pine planted about that date.

I regret that I am unable to locate the sites of the other plantations except those which contain beech, which all now consist of pure beech crops with a few oak scattered through them.

In 1910 I sold about 4 acres of large rough beech (almost certainly that planted in 1772) for about 1½d. per cubic foot. The beech was pure, but about 10 acres of old wood adjoining, which was included in the same sale, consisted of mixed oak, larch and Scots pine. This was no doubt part of the remainder of the 28-acre plantation planted in the same year. Many of the larch measured over 100 cubic feet, and the Scots pine was not much, if any, behind them. They were all perfectly sound

SCOTS PINE AT SHAMBELLIE, PLANTED ABOUT 1777.

[*To face p.* 42.

and of first-class quality. The prices obtained were 9d. to 10d. for larch and 5d. to 6d. for Scots pine. The oak, though sound, was not of great size, the land being thin and steep and better adapted for conifers. This area is now growing a promising crop of young European larch.

The remainder of the 40 acres of old timber still standing consists chiefly of oak, mixed here and there with larch and Scots pine, the latter sometimes in groups. There are also several acres of pure beech. The elm has entirely and the ash almost entirely disappeared, the granite soil not being suitable for their growth or the drainage free enough. These species have been repeatedly planted in later years on the estate, but the result has always been the same. The aspect of the plantations mentioned is south and east, the elevation from 100 to 300 feet above the sea, and the slope varies from gentle to steep.

Shambellie Hill is about two miles from the Solway Firth, and is the first considerable rising ground facing the sea.

The natural oak wood mentioned was coppice, which was converted into standards and filled up with larch, part of it in 1844 and the remainder in 1860. The coppice oak removed in 1844 realised £44, 10s. per acre at 1s. per cubic foot for the timber and £6 per ton for the bark. I am unable to give the price at which the wood was sold in 1860, but the bark fetched £7 per ton. I sold the timber on these areas in portions from 1909 to 1912, when the price averaged about £65 per acre. The larch was of good quality but the oak small, its value averaging only about 2s. 6d. per tree.

I regret that I am unable to give more detailed information on the progress of the woods mentioned in the letter, but I venture to hope that these notes may, notwithstanding, be of some interest.

5. A Summary Report on the Forests, Forest Trees, and Afforestation in Chosen (Korea).

By Ernest Henry Wilson, M.A., Dendrologist, Arnold Arboretum, Harvard University, U.S.A.

The forests of Chosen are divisible into three groups, viz., (I.) Forests of Softwood Trees (Conifers); (II.) Forests of Hardwood Trees (Deciduous-leaf Trees); (III.) Mixed Forests of Soft and Hardwood Trees. From the viewpoint of their timber, and in order of merit, the most important component elements of the forests are:—

I.—Softwood Trees.

Picea jezoënsis . . .	Tohi.
Picea Koyamai . . .	Chosen Hari-momi.
Pinus koraiensis . .	Chosen-matsu.
Larix dahurica, var. Principis-Rupprechtii . .	Chosen Kara-matsu.
Abies nephrolepis . .	Toshirabe.
Taxus cuspidata . .	Araragi.
Pinus densiflora . .	Aka-matsu.
Abies holophylla . .	Chosen-momi.
Juniperus chinensis . .	Biyakushin.

II.—Hardwood Trees.

Zelkova serrata . . .	Keyaki.
Juglans mandshurica . .	Manshu-kurumi.
Betula Schmidtii . .	Onore-kamba or Pak-tal-nam.
Quercus mongolica . .	Mongori-nara.
Fraxinus mandshurica .	Manshu-toneriko.
Castanea crenata . .	Kuri.
Quercus glandulifera . .	Konara.
Populus Maximowiczii .	Doronoki.
Populus suaveolens . .	Chosen-doronoki.
Populus tremula . .	Chosen Yamanarashi.
Tilia amurensis . .	Amuuru-shinanoki.
Quercus serrata. . .	Kunugi.

The useful qualities of the woods of these different trees are well known, nearly all being employed in general construction work in Chosen. A few, however, are especially valuable for certain purposes, as follows:—That of the Chosen Kara-matsu

(*Larix dahurica, var. Principis-Rupprechtii*) for telegraph poles and ships' masts; that of the Biyakushin (*Juniperus chinensis*) for the manufacture of writing-pencils; that of the Tohi (*Picea jezoënsis*), Chosen Hari-momi (*Picea Koyamai*), and of the Toshirabe (*Abies nephrolepis*) for making wood-pulp; that of the Doronoki (*Populus Maximowiczii*), the Chosen-doronoki (*Pop. suaveolens*), the Chosen Yamanarashi (*Pop. tremula*), Amuuru-shinanoki (*Tilia amurensis*), and of the Toshirabe (*Abies nephrolepis*) for making match-splints; that of the Onore-kamba (Pak-tal-nam) (*Betula Schmidtii*) in the manufacture of Korean and Chinese carts; and that of Manshu-kurumi (*Juglans mandshurica*) for making rifle stocks.

Forests of Tohi, Chosen Hari-momi, Toshirabe, Chosen-matsu, and Chosen Kara-matsu, mixed or more or less pure, cover vast areas on the mountains in the extreme north of Chosen. The Chosen Kara-matsu is found only on volcanic soils in north-eastern Chosen, and especially on the Chang-pai-san range of mountains, where it covers large areas and forms extensive forests, often quite pure. The Aka-matsu (*Pinus densiflora*) is found from the extreme south to the extreme north of Chosen, mixed with hardwood trees or forming pure woods. The other softwood trees are widely scattered through Chosen. The remains of forests of hardwood trees occur here and there throughout the length and breadth of Chosen, but extensive forests of these trees grow chiefly on the mountains of the Unsan district, and on the coastal ranges of south and north Kankyo.

If properly conserved these forests are capable of supplying in perpetuity vast quantities of useful timber, and of being a perpetual source of national revenue.

The present system of the annual felling being done in more or less rectangular areas of forests might with advantage be changed to felling in straight or diagonal drives—say five cho wide—thus sectioning the forests into separate blocks and insuring considerable safety against forest fires.

A natural renewal of forests may be effected if, when the forests are being felled, mother trees be left standing. In the matter of hardwood forests and forests of Tohi (*Picea jezoënsis*), Chosen Hari-momi (*Picea Koyamai*), and Toshirabe (*Abies nephrolepis*), this is the most simple and economical method, although it often needs to be supplemented by the planting of

seedling trees raised for the purpose in nurseries attached to forestry stations.

The regeneration of forests of the Chosen-matsu is a more difficult task. Its seeds are so much sought after and eaten by rodents and certain birds, that the only way of insuring the growth of new forests of this tree is by raising seedlings in quantity in nurseries, and planting them when sufficiently large on the mountain sides and in the valleys. The Chosen-matsu grows well with the Doronoki and the Chosen-doronoki, and mixed plantings of these trees would make successful and remunerative forests.

Chosen Kara-matsu seedlings will not vegetate naturally in forest soils rich in humus, and any one who traverses the forests of this tree in north-eastern Chosen will be struck by the entire absence of young plants, except alongside the paths or in areas devastated by fire. However, regeneration of forests of Chosen Kara-matsu may be readily effected if the undergrowth be burned off some five years before the forests are cut down. The interval of five years, from the burning of the undergrowth to the felling of the trees, will afford the seeds shed from the parent trees ample time to vegetate and develop into seedling plants capable of taking full care of themselves. After five years the whole of the treated area of the Chosen Kara-matsu forest should be felled. This burning of the forest undergrowth, if done carefully and under the control of competent forestry officers, would entail no danger to the existing forest of Chosen Kara-matsu.

From Keijyo south, the Keyaki (*Zelkova serrata*) could be planted with success. The planting of the Kuri (*Castanea crenata*) in quantity is most wise, and should be encouraged; the planting of Aka-matsu (*Pinus densiflora*) promises to be the most successful work in reafforestation yet attempted in Chosen. In reference to this tree, I venture to suggest that it might with advantage be planted more thickly together than is at present usually done. This pine will grow on the most barren of soils; in fact it thrives where no other tree will grow, but it is important that the seeds should be obtained from native trees only. For the preservation of river-banks I strongly recommend the planting of the No-nire (*Ulmus pumila*). As a street tree the form of the Chosen Yanagi (*Salix koraiensis*) with pendant branches is very desirable, since this tree can be pruned and

its size kept in bounds co-ordinate with the width of the streets and the size of the houses. For avenues in parks and public places in Chosen, there is no more handsome tree than the Ginnan (*Ginkgo biloba*).

The area of mountain-land in Chosen utterly deforested and covered with coarse grasses and low shrubs is enormous, and to clothe this with trees, though a pressing, is a most formidable, task. Planting it by hand with trees is almost out of the question, for such work would be so enormously costly both in time and in money, and some speedier and less expensive method must be sought. I suggest that these waste mountain areas be severely burnt over and afterwards thickly sown with the seeds of Shira-kamba (*Betula japonica*), Ko-onore-kamba (*Betula dahurica*), Jezo-no-take-kamba (*Betula Ermanii*), To-kamba (*Betula costata*), and Chosen Kara-matsu (*Larix dahurica, var. Principis-Rupprechtii*), all mixed together. The sowing of these mixed seeds should be done broadcast in the late autumn, in order that the seeds may enjoy the benefit of the winter snows. These Kambas (birches) and the Chosen Kara-matsu (larch) will grow together harmoniously for twenty or thirty years, the Kambas at first the faster, but ultimately the Chosen Kara-matsu will overtop and kill them, and pure forests of Chosen Kara-matsu will remain. The wood of these Kambas is of little value except for fuel, but the trees afford just the requisite amount of shade that seedlings of the Chosen Kara-matsu demand. This experiment is both novel and drastic, but I am convinced that it can be safely conducted and with much promise of success.

Before commencing the re-afforestation of these waste mountain areas, and, for that matter, of any part of Chosen, the land required for purposes of agriculture should be clearly delineated, and the indiscriminate burning of the vegetation on the mountain sides, now so commonly done by irresponsible farmers (squatters), rigorously suppressed.

Throughout the deforested regions of Chosen insect pests injurious to trees and vegetation generally are lamentably abundant, and, whilst predatory birds (magpies, shrikes, cuckoos, crows, etc.) are plentiful in these regions, there is a marked absence of insect-eating birds. The latter should be closely protected, and the predatory birds greatly reduced in number, in order that the balance of nature may have a chance of

restoring itself and insect pests cease to menace, as they do at present, the very existence of tree-life.

The planting of the Hari-enju or False Acacia (*Robinia pseudacacia*) and the America Yamanarashi or Lombardy Poplar (*Populus nigra, var. italica*), of which so much has been done, is an experiment the value of which time alone can prove. To this report I attach a letter from Professor Charles S. Sargent, Director of the Arnold Arboretum, Harvard University, in which is given the evidence for and against the False Acacia. The so-called America Yamanarashi is not an American but an Italian tree, which has absolutely no claims to value as a forest tree. In landscape gardening it has its proper place in narrow vistas and against tall buildings. Since it grows rapidly it may be regarded as a cheap source of inferior fuel, but from the viewpoint of permanent afforestation work this tree is without value, and its wholesale and indiscriminate planting is to be strongly condemned.

The *experimental* planting of exotic trees is desirable and much to be recommended, but it must not be forgotten that it takes at least half a century before any definite opinion of their value as forest trees can be formed. The tendency of certain exotic trees is to grow quickly during the first few years from planting, but after one or two decades the rate of growth slackens and soon ceases, and the trees become prematurely old, decrepit, and valueless as forest trees. In Japan, where trees have been planted from time immemorial, it is the *native* trees that have been so successfully employed. Re-afforestation work, in any and every country, if it is intended to have permanent value and results must be done with trees *indigenous* to the country. Chosen is fairly rich in native species yielding useful timbers, and it is *these* that should be relied upon for the permanent re-afforesting of the country.

COPY OF LETTER.

ARNOLD ARBORETUM, HARVARD UNIVERSITY,
JAMAICA PLAIN, MASS.,
11th September 1917.

DEAR MR WILSON,—I am pleased to get your letters of the 9th of August.

You ask me about *Robinia pseudacacia*. It produces very hard, strong wood which is extremely durable in contact with

the ground. No tree yields more valuable fence posts, and the timber was formerly much used in construction. The *Robinia* was at one time very largely planted in New York and other northern states as a timber tree, but it is always, outside its natural habitat on the Appalachian Mountains, so injured by boring insects that its cultivation has been abandoned; and although the tree is very hardy in much colder regions than Massachusetts, it is practically impossible, thanks to the borers, to keep trees alive here more than a few years.

It is claimed that when the trees are planted close together in forest work they suffer less from borers than isolated trees, but I have no proof of this. In recent years the *Robinia* has been planted in great quantities in western Pennsylvania by the Pennsylvania Railroad to produce railway ties, but it is too soon to speak of the success of this undertaking. The wood, of course, would make good mine timber, but I should think that *Pinus densiflora* would serve equally well for that purpose, and I believe that sticks sufficiently large for the purpose could be produced more rapidly and with greater certainty from the pine than from the *Robinia*.

Populus monilifera, or *deltoidea*, suffers a good deal from borers when young, but when the trees get old enough to form thick bark they appear to be able to resist. I never heard that the wood had been used for match sticks, but there is no reason why it should not be.

I should think a much better tree to plant in Korea than either the Lombardy Poplar or the Cottonwood would be what is known in this country as the Carolina Poplar, which is probably a hybrid between the Lombardy Poplar and the Cottonwood. This tree grows with extraordinary rapidity, is perfectly hardy, and, so far as I know, is not much attacked by borers. The wood would have the same value as that of the Cottonwood. This tree has been very largely planted in the cities of the middle west as a shade tree. It does well, but it grows so vigorously that the roots interfere with sewers and drain-pipes, and for this reason it is being abandoned. Why would *Populus Maximowiczii* not be the right poplar to plant in Korea?—Faithfully yours, C. S. Sargent.

The foregoing report by Mr E. H. Wilson will be read with interest by the members.

Of the conifers of Korea which are enumerated by Mr Wilson, few are in common cultivation, though there are some good trees in this country of *Picea jezoënsis*, which used to be known by various names, such as *P. ajanensis* and *P. hondoensis*. *Juniperus chinensis* has been cultivated for long, and seedlings of Mr Wilson's collecting of *Abies nephrolepsis*, *A. holophylla*, and *Picea Koyamai* are doing well. It is now seven or eight years since *Larix dahurica*, *var. Principis-Rupprechtii* was introduced, and seed of it was distributed four years ago by the Scottish Board of Agriculture, the plants raised from which are generally thriving and much more promising than any plants I have seen of its unsatisfactory near neighbour *L. sibirica*. *Pinus koraiensis* and *P. densiflora* were introduced to Europe in 1861 and 1854 respectively, but neither gives much promise of becoming valuable timber.

The broad-leaved species mentioned by Mr Wilson are none of them familiar in British collections. The timber of *Quercus mongolica* and *Fraxinus mandshurica* have both been imported to England, and I have used them successfully for flooring at Dawyck. *Populus Maximowiczii* was sent to me some years ago by Professor Sargent. It is a poplar of handsome foliage, but, unfortunately, very liable to injury from autumn frosts in our climate. *Fraxinus mandshurica* was introduced at Kew in 1882, but suffers in this country from spring frosts. *Zelkova serrata*, better known here as *Z. acuminata* or *Planera japonica*, introduced by Veitch in 1861, has not proved a success, and few have reached 30 feet in height, though in eastern America this tree flourishes. It will be noted that Mr Wilson classes it as the most valuable hardwood of Korea. The oaks mentioned were introduced to this country some twenty to twenty-five years ago, but not one of the three gives much promise so far. All are thriving at the Arnold Arboretum. *Tilia amurensis*, so far as I know, has not yet been introduced into Europe, and *Juglans mandshurica* and *Castanea crenata* are little known.

Speaking generally it would seem that Korean trees are more likely to thrive in eastern America than in western Europe. Our summers are probably not long or hot enough. There is a marked correspondence between the climates of western America and western Europe, and eastern Asia and eastern America as regards the growing of trees. Of the American Pacific Coast trees, so many of which are our most valuable acquisitions,

there is not one really hardy at the Arnold Arboretum in Massachusetts; and whereas many Chinese and Korean trees are growing well at the Arnold Arboretum, it is deplorable how few of the splendid eastern American hardwoods do well in our country.

It is much to be hoped that the seeds we have received of Mr Wilson's collecting for two years past in Korea will in time enrich British collections with many fine trees from that region.

What Mr Wilson says in his last paragraph of the desirability of native trees for re-afforestation purposes must have been written with eastern America in his mind. We would be badly off indeed in Scotland if our planting of conifers was confined to that of Scots pine, and the people of South Africa and Chile do not regret the introduction and general planting in those countries of Australian gums, and the Californian *Pinus insignis* and *Cupressus macrocarpa*. The finest coniferous woods of Portugal consist of *Cupressus lusitanica*, introduced from Mexico 400 years ago. F. R. S. Balfour.

6. Damage to Vegetation by Smoke and Fumes (The Selby Smelter Commission Report).

By A. D. Richardson.

The report of the Selby Smelter Commission, of which Dr Lauder has given us such a lucid digest in the July part of the *Transactions*, is no doubt a valuable contribution to a somewhat meagre literature on a very important subject, and although in this case the injury was to vegetation generally, and not to silvicultural crops in particular, the report is none the less interesting on that account. I think, however, that as Dr Lauder seems to consider the procedure in this case greatly superior to ours, and has introduced some remarks regarding our present methods in investigations of this sort which, coming from the Consulting Chemist to the Society and a scientist of his standing and ability, might tend to prejudice unduly readers of the article against them, what he has said should not be allowed to pass unnoticed, and I now wish to say a few words in defence of our procedure, and to show, so far as I am able, that it is not quite so defective as one might be led to believe from the very

glowing eulogy of the work of the Selby Commission which he has so ably and attractively presented to us.

In its essentials the Selby case does not seem to differ greatly from most of the cases with which we are familiar here. Dr Lauder states that "the early history of the dispute . . . followed familiar lines." In 1908 an action was brought against the Selby Smelting and Lead Company by "the people of the State of California" on the ground that the fumes and smoke from their smelting operations were "detrimental to vegetation and to the health of the people." The action was tried "before a judge in the usual manner," and judgment was given against the Smelting Company, "who were required by the Court to carry on their operations in such a manner as not to cause damage to the vegetation or annoyance to the inhabitants of the district." The Smelting Company appealed twice against this decision, but it was confirmed by the Supreme Court of the State in 1912, and one would have imagined (assuming that the Californian courts have the same powers as ours have) that nothing further remained to be done but to enforce the Court's decree. In the following year (1913) "trouble again broke out afresh." The inhabitants of the country near the works alleged that "a nuisance still existed, and that the terms of the interdict were not being observed"; and apparently instead of steps being taken to have the decree of the Court enforced, and the Smelting Company compelled to implement their obligations, as I am quite certain would have been done here, at the request of both parties the Court set up a tribunal of scientists to re-investigate the whole matter on the ground that "sufficient data did not exist to enable the question to be settled," and it would seem that Dr Lauder favours some such procedure here when he speaks of "the great advance which has been made by the appointment of this Commission in the method of settling disputes involving scientific evidence and investigation," a view which is confirmed by his statement towards the end of the review that "our methods of settling similar disputes are most unsatisfactory, and there is probably no branch of legal procedure in which the necessity for reform is more urgent."

In the Selby case the scientific commission set up by the Court consisted of three scientific experts—a mining expert, a professor of organic chemistry, and a chemical engineer—with a trained scientific and technical staff, including 10 chemists,

2 plant pathologists, an entomologist, 2 soil experts, a protozoologist and bacteriologist, and 9 assistants to these, and the Commission had power to call and examine witnesses. No skilled practical agriculturists, horticulturists or silviculturists are mentioned as forming part of the Commission, and presumably anything which they may have had to say about the matter would be in the form of "evidence," the pros and cons of which would be weighed up by three scientists, instead of by a judge, or judges, in a court of law. After a great amount of fresh scientific investigation the Commission came to the same conclusion that the legal court, following "familiar lines," had already arrived at, and if, as seems likely, the same object, viz., the abatement of the injury and nuisance, could have been obtained simply by the enforcement of the Court's decree, the work of the Commission, so far as this goes, seems to have been a great waste of time and money. Besides, by the decision of the Court the Company were bound to carry out such alterations as would have accomplished this *at their own expense*, and as it could have been done quite well by the employment of one or two experts in this particular line to advise them as to the best methods of preventing the escape into the air of matters injurious to vegetation and people's health, the Commission seems to have been superfluous.

The Commission began its work by reviewing the evidence given in the legal actions, and, as they found that much of it "would not stand the test of scientific scrutiny," the whole of it was rejected, and a fresh investigation commenced. The outcome of this was that methods for purifying the smoke before allowing it to escape into the air, and various other alterations in the methods employed at the works were adopted, "partly by the Company themselves and partly at the request of the Commission," so that the inquiry was "narrowed down to determining the amount of sulphur dioxide in the air in the neighbourhood of the works under varying atmospheric conditions, and to discovering how much of this gas must be present in the air in order to cause definite damage to vegetation." But although it was narrowed down to this point, and although no less than 4862 analyses of the air were made, unless Dr Lauder has omitted to mention it, we are not told either what proportion of sulphur dioxide there was in the air, or what proportion of this gas must be present in the atmosphere in order to cause

damage or death to plants. I have no doubt whatever that all the investigations were carried through in the most careful manner, and that the investigators had in view only the object of arriving at a just and equitable conclusion; but I think that Dr Lauder's strictures on our methods are too drastic. After all, in the Selby case the scientific investigations merely confirmed the decision of the legal court which first tried the action, and with the exception that the Commission found that "much of the evidence" taken in this Court "would not stand the test of scientific scrutiny," no fault seems to have been found with the procedure there. Had the decision of the legal court been reversed as the result of these investigations, the matter would, of course, have assumed a somewhat different aspect.

I cannot lay claim to an acquaintance with cases of this sort such as Dr Lauder has no doubt had, but from my limited experience of them I think I can say that Dr Lauder is too severe in his assertion that in our Courts "the verdict depends too much on the skill of the expert witnesses undergoing cross-examination, and on the ability of counsel employed, and too little on the real merits of the case." Dr Lauder's experience may have been quite different from mine, but I can confidently say that in the cases with which I have been connected I am not aware of a wrong verdict having been given in a single instance. On the other hand, I am doubtful if a tribunal like the Selby Commission would always come to correct decisions in cases of this sort. What better qualifications would such a tribunal have to weigh up evidence and come to a decision on matters of fact other than those in their own special sphere than a judge or judges in a court of law? And it has to be kept in view that there are many other points—legal and other—which have to be considered in these cases besides the purely scientific ones, such as the absolute amount of sulphur dioxide in the air. I will give two examples from personal experience. In A damage to plantations by smoke and fumes was alleged. There was no doubt whatever that the trees had been severely damaged in the vicinity of the source of pollution, especially as the prevailing winds were favourable to the carrying of the smoke and fumes over the area occupied by the plantations. But the allegation was that not only there, but also over a large area at a considerable distance from the source of pollution the plantations had seriously suffered from the same cause. One

feature in this case—and to my mind the most important one in connection with it—was that in the vicinity of the source of pollution some portions of the plantations had grown better than others, and much better than some of those at a very considerable distance away from it. The trees were almost wholly of one species. Why this difference in growth? The answer is a very simple one, but one which could only be given by a skilled practical forester. It was a case where an initial mistake had been made in the selection of the crop for the particular soil and locality, and the failure of the crop, instead of being due to poisoning by fumes, was chiefly due to this initial mistake coupled with bad forestry afterwards. I don't think this question could have been properly decided by a tribunal like the Selby Commission, and I don't think the decision which was given was a wrong one. In B the case was essentially similar to A, but the position of the plantations in relation to the prevailing winds was reversed, which placed them under more favourable conditions relatively to the source of pollution than in A. The allegation was practically the same as in A. Many of the old non-coniferous trees, both in the vicinity of the source of pollution and at a considerable distance from it, were stag-headed, and their boles were covered with epicormic branches. Obviously they had been overthinned, and they had almost reached the limit of their existence, and were a long way past financial maturity; in fact they had made practically no increment for a number of years. In a young coniferous plantation, instead of the dead and dying trees being removed, as would have been the case under good management, I saw the best trees being felled, *and the dead and dying left as examples of the effects of noxious fumes and smoke on young conifers!* How would a tribunal like the Selby Commission have dealt with a case of this sort? The chemists would, no doubt, have found sulphur dioxide in the atmosphere. Would they have attributed the condition of these trees to its presence?

Dr Lauder, referring to our legal procedure, states that "in all such cases the Court should have the assistance and advice of one or more Assessors, who should be men of high standing in the department of science involved, and who should have no partisan interest in the case." As matter of fact, a practice of this sort prevails, and has prevailed for a very long time, in our courts. It sometimes happens that, in order to enable him

to arrive at a proper decision, a judge may require some further assistance than he has got from the witnesses in the case, and in such cases he usually exercises the power he possesses to remit any point over which he may have difficulty to one or more independent experts for their opinion. This is practically the same thing as Dr Lauder suggests, and it seems to me to be quite adequate to meet all requirements.

If a revolution in our legal procedure is necessary in cases of this sort, I doubt if that of the Selby Commission furnishes the object-lesson which Dr Lauder views with so much favour, and I am quite certain it has little to recommend it on the ground of economy.

7. Employment of Women in Forestry.

(*With Plates.*)

By George Leven.

The dearth of labour during the last four years has brought the need for "dilutees" in forestry operations, as in other businesses, into prominence. The difficulties in the way of the employment in forestry, on a large scale, of prisoners of war, Belgians or even our own discharged soldiers, latterly turned the search for necessary labour to a source that had only been tapped in a desultory manner previously. The employment of female labour in forestry is, nevertheless, not of recent origin, as seasonal work has always absorbed a certain amount of casual labour, provided by women and girls. The planting out of young trees has long been taken part in, more or less, by young girls, and in the days when oak bark was more made use of than now, for tanning purposes, large numbers of women and girls took an active part in all the operations connected with its harvesting.

The writer has, during a period extending over a quarter of a century, had the supervision of women engaged on estate work of various kinds. As occasion arose they were turned on to forestry work of a light nature, and they generally gave a very good account of themselves. The class of woman employed was usually that brought up in the district and used to agricultural work, or, better still, members of the families of estate employees, who had been familiar with the nature of the work

Hendersyde—On the Move.

Hendersyde—Felling.

[*To face p.* 56.

HENDERSYDE—LAYING IN.

HENDERSYDE—CROSS-CUTTING.

from early youth. The latter proved, invariably, the most adaptable, and often attained to a commendable degree of proficiency.

Recently several of the larger wooded estates in the south-east of Scotland have had recourse to female labour to eke out the forestry staff, with, of course, varying degrees of success. Timber merchants, in the same area, have also been employing women in various capacities in connection with their operations.

What is probably a unique instance of what women are capable of doing came under the writer's observation recently. A number of women have been employed for some time on the Hendersyde forestry staff, the male members being in the minority. Among other operations the felling, snedding, and cross-cutting of a few hundreds of very heavy hardwoods (ash, oak, beech, elm, etc.) was undertaken by the staff, the women performing the major portion of the work, even to the sawing off of the roots of trees with cubic contents up to 230 feet!

Contractors for felling pit-wood have also been employing women at this work, and they are giving every satisfaction, their work being done in a "workman"-like manner. In some cases the heavier trees are "laid in" and snedded by men, but there are areas being mostly operated by women.

It has been suggested that women cannot be employed on routine work on a wooded property, but the writer's experience is that employment can be continuous. It is admitted that they can be usefully employed during the planting season and on nursery work, but this does not by any means exhaust their capabilities. On recently felled areas their work in clearing and burning brushwood is probably more economical than that of men, particularly skilled woodmen. The erection of netting fences for protection, with some skilled assistance, can be undertaken by women. The cleaning out of surface drains, on ordinary forest soils, has been proved not to be beyond their strength. The digging of pits does not require the skill that notch-planting entails, to be a success, and on average soils this can be well done by women. The clearing of young plants from rank herbage, cutting bracken, rushes, etc., are operations that require a quick eye more than great strength, and fall in periods when men can be more usefully employed on heavier work. Thinning and light pruning, although not much practised at the moment, fill up part of the round.

It is not suggested that women are fitted for performing *all* manner of duties that come under the domain of forestry, nor that *all* women are suited to certain duties, but probably enough has been said to show that certain women are capable of carrying out certain operations connected with forestry in an economical manner, and at the same time benefiting materially in health and physique.

The above relates wholly to the practical side of the matter, and the writer feels that he is unfitted for dealing with the technical part of it, or even to speak of the theoretical training of women in forestry; but he must not be held as looking upon them simply as "hewers of wood and drawers of water," as he believes them capable of doing much more when properly trained. A thoughtful article *ápropos* of this, by Mr G. P. Gordon, B.Sc., appears in the *Quarterly Journal of Forestry* for October 1918, in which he deals very tactfully with the causes of success and failure.

There are, as stated above, certain classes of women better suited than others for forestry work, but this is a matter that may right itself. When the glamour of "war work" passes away and the fashion changes, probably many of those who set out to dignify labour will give up forestry and other forms of land work, but it is evident from what has been done during the war that women are able and willing to tackle sustained labour. Even if a former attempt at dual control in keeping the trees (in a garden) was not a complete success, it looks as if women were destined to help to re-clothe the naked forest areas and hillsides of Britain with trees.

The writer has always advocated the conjunction of small-holdings with forestry, for the mutual advantage that would accrue through available seasonable labour on the part of the male members of the holding families, but probably these same holdings might do as much in providing the women to carry on a great part of the routine work in forestry. Probably very few of the townsfolk could be tempted to go "back to the land," especially to the areas to which the greater production of timber must be relegated; therefore the families born and bred *in situ* should be looked to to carry on the imperative work of afforestation.

8. Nature as the Forester's Guide.

By A. Murray.

A careful observer of nature will recognise in almost every instance coming under his notice the vigorous growths of all kinds of plants when occupying positions suited to their requirements. In the rearing of plantations, therefore, the object of the planter should be to assist nature by a proper selection of species suited to the different conditions. The study of nature's laws is of great practical importance in this respect to every one connected with work of this kind; consequently, I have been induced to attempt a brief outline of some of my observations on this subject. In doing so I do not profess to offer anything new or original. My chief object is to set forth some observations in the hope that they may encourage others to study a subject of great and general utility.

It will be readily admitted by all that the work of the tree planter, and others concerned with the cultivation of the soil, is more directly dependent on nature than is that of those who are engaged in most other industries. Agriculture is near to forestry in this respect, and both are industries of extreme importance in the economy of any nation. Agriculture, however, is different from forestry in that the farmer can sow and reap his crops within a year, while the tree planter must wait many years for his harvest. Again, the farmer may, within certain limits, treat the soil so that various crops can be produced, but the tree planter must take the soil and situation more or less as they exist, and suit his crops to them.

Amongst our common forest trees many are suited for the same soil conditions. The amount of moisture, the altitude, and proximity to the sea may produce conditions which favour only a limited number of species, however. A certain amount of moisture is necessary for all plants. Some will thrive when there is an excess of moisture, provided it is always in a state of motion, but few plants will thrive on flat lands surcharged with water, until a thorough system of drainage is performed. Many instances have been recorded of rapidity of growth, or otherwise, without, I believe, taking into consideration the cause or minutely examining the reasons.

It is seldom that the practical forester or tree planter is capable of making a chemical analysis of the soil. Indeed, I

am doubtful if such an examination would form a reliable guide to the proper distribution of the various trees. What comes more within the reach of the practical planter is a knowledge of the natural existing vegetation, which, if properly understood, will convey a good indication of the under-lying soil. A practical knowledge of this, together with the requirements of the various species to be planted, will enable each variety to be placed in a soil and situation congenial to its growth.

Most of the land now under contemplation for afforestation will consist of mountainous or semi-waste land. On this will be found a great variety of naturally-grown plants, and perhaps the most abundant will be the common heath. The strength of these plants alone will give a good indication of the depth and the porosity of the soil. Soils growing heather will generally be found most suitable for the growth of the Scots pine. When, however, there are mixtures with other plants, such as *Potentilla tormentilla*, *Holcus lanatus*, and other common grasses, several varieties of trees may succeed very well. The common whin is a variable plant, and is not a safe criterion as to soil.

The size of these plants will, however, form a guide as to the fertility of the soil, especially when growing together with such plants as the common thistle, ragwort, etc. When the plants of the natural flora are dwarfish with slender stems, this will generally indicate a light gravelly soil. Broom is usually found in dry situations. When it is strong and healthy—growing together with yarrow, bird-foot-trefoil, and wild clover—the soil and subsoil are generally good for tree-growth.

Foxglove indicates a medium soil, inclined to be dry, and a great variety of trees may be grown in soil on which it flourishes. The presence of male fern on the ground does not always give a regular indication of the quality or fertility of the soil. Such plants, although they may exist, do not usually luxuriate except upon a good soil. The common juniper, associated with the bracken fern, indicates a superior class of soil.

The most hopeless soil in its natural conditions is that covered with species of *Scirpus*. Unless a thorough system of drainage of such a soil is performed sometime previous to planting, it is vain to expect any kind of tree to succeed on it.

These are a few of the larger and common varieties of plants

generally found growing on plantable ground. But several hundreds of smaller plants will also be found, all of which will occupy a situation peculiar to themselves, and many an object-lesson may be learned from these.

The ordinary observer may find a little difficulty at first in obtaining a knowledge of the plants growing naturally on any piece of ground, but this knowledge can soon be acquired, and it will not only add considerably to the pleasure to be derived from the cultivation of forest trees, but it will usually convey a good indication of the varieties suitable under the varying conditions of soil and locality. When these natural agencies are ignored, errors and disappointments will generally follow which will only be discovered after the lapse of several years.

Even after we have followed nature's guidance, the results may not always be as we had anticipated. This may arise from other causes which we are unable to control, such as insect pests, fungoid diseases, and wind storms.

It is quite evident from the remains to be found in our peat bogs and in the uplying districts of Scotland, that these were at one time covered with forests which were destroyed by fire and other agencies. So complete, we are told, was the destruction of these forests, that in 1707 all that remained of the grand old Caledonian forests were a few remnants in a most deplorable condition. Under existing conditions, natural re-afforestation of these hills cannot be carried out; consequently, the first important item for the production of healthy forests is the collection of seed from healthy, well-grown trees.

The nursery treatment of tree plants does not always come under the care of the planter. Nevertheless, the artificial method should aim at producing, as nearly as possible, a root-system similar to that produced by nature, with the main root vertically under the plant and the side rootlets evenly developed around it. Under the common system of hand-laying the plants are usually overcrowded in the line, the stems twisted and bent, and the roots matted and doubled. Such plants are always less healthy — more liable to suffer from wind and from the attacks of insects and fungoid diseases—than naturally-grown specimens.

Various designs of transplanting laths have now been in use for several years, any one of which, if properly handled, will ensure conditions such that the plants develop natural roots,

and will, to a great extent, facilitate the work of transplanting, especially with inexperienced workers.

Frequent transplanting during the nursery stage, if properly performed, will encourage fibrous roots. This, however, has often the tendency to check growth till late in the season, with the result that the young shoots get nipped with frost—especially is this the case with Douglas fir and Sitka spruce. Destruction from frost does not arise so much from the severity of our winters as from the inability of some plants to ripen their wood before the early frosts set in.

Raising, and thus loosening, the roots of frost-tender plants in the nursery lines during the autumn with a five-pronged fork, and afterwards firmly treading the roots into the soil, will cause a cessation of growth, when the young shoots will become ripened off and ready for winter.

In carrying out planting operations no effort should be spared to encourage the trees to develop strong roots and to establish canopy soon, so that the surface vegetation may be destroyed at an early age. It is also to be observed that when this takes place the rate of growth is considerably increased—growth in height increases as each tree competes with its neighbour for space. The trees are by this means drawn up tall, clean, and straight. By the exclusion of light the lower branches are also killed off, so that the timber produced will be clean and close grained.

Nature, however, demands that a growing tree at all stages of growth must have room for root ramification, and be possessed of a certain number of live branches as feeders for the tree. Therefore, if the crop is of uniform growth some artificial assistance must be given in the way of thinning.

In order to produce the best commercial timber, thinning should commence just before the trees are deprived of their necessary amount of live foliage, and before they become too tall and slender in proportion to their girth.

The work should be continued at close intervals, according to the rate of growth and the requirements of each variety for the development of its necessary foliage.

This will bring about conditions which will cause the trees to lose their side branches before they become large. Careful attention to thinning will modify and balance growth so that clean and close-grained timber will be produced. Proper attention in thinning is a most important matter, and one more

difficult to describe on paper than to carry out in practice. Some people maintain that our best timber has been got from unthinned woods—referring to the imported article and to our old natural forests when, as they say, there were no foresters to spoil the crop by thinning.

These, however, were the produce of nature when the trees in their younger stages of growth were of different ages, size, and vigour, so that although the smaller ones may suffer and become suppressed they act as undergrowth to the dominating trees and prevent the expansion of strong side branches, thus compelling them to produce clean and close-grained timber without the aid of artificial thinning. Moreover, the production of this timber took hundreds of years, and perhaps no rates or taxes had to be paid on the land.

All trees are not alike in their requirements for growing space, there being light-demanding and shade-bearing varieties. It is, therefore, necessary to observe that sufficient growing space be provided to suit the requirements of each class. Most of our light-demanding conifers, if once deprived of their necessary amount of live foliage, never have the power to regain it, and will remain lean, stunted poles.

The effect of wind in this country is probably the greatest difficulty in the way of successful rearing of clean, well-grown trees. A proper margin consisting of hardy well-rooted varieties clothed to the ground with healthy foliage will obviate the danger to a great extent.

The period of rotation is also a matter for consideration in the management of plantations. In a situation difficult of access, where the extraction of heavy trees would be costly, early realisation, or the production of light poles or mining timbers, may be the most profitable. At this stage the trees can be easily handled. A greater number of stems can be grown on the same area of ground, while two crops can be produced in the time it would take to produce one of matured timber.

Whatever object the planter has in view, it should be his endeavour to assist nature in the production of the greatest quantity of the most valuable timber.

9. Forestry and the Development Commission.

The following paragraphs are taken from the section headed "Forestry" in the *Eighth Report of the Development Commissioners*:[1]—

1. General.

"During the year under review the Commissioners received the Report of the Forestry Sub-Committee of the Reconstruction Committee. Before this Sub-Committee had commenced its work the Development Commissioners had set forth in a Memorandum submitted to the Reconstruction Committee the advantages of leasing and proceeds-sharing as compared with a system of land purchase. The Commissioners have always contemplated that part of the land to be afforested by direct State action must necessarily be acquired by purchase outright; but with a view to reducing as far as possible the inevitably serious expenditure on the creation of commercial forests, after careful enquiries, they proposed these alternative methods. The Commissioners observe with satisfaction that these methods have been approved by the Reconstruction Sub-Committee.

"In their last Report the Commissioners stated that it was not necessary for them to urge the importance of the afforestation of land at present unproductive. The experience of the war and the extensive felling of forests both in the United Kingdom and on the Continent have emphasised the national importance of home-grown supplies of timber. The Commissioners have continued to consider the most appropriate and economic methods of promoting the development of forestry in the United Kingdom, and desire to urge the importance of the immediate preparation of afforestation schemes, so that they may be ready when the war is over. They have recommended grants for survey work, among other purposes, and considerable areas of land have been mapped out as suitable for planting. They think it right, however, to state plainly that in their view, which they have communicated to the Departments concerned, the preparation of definite schemes should be taken in hand at once.

"Reference is made below to the grant recommended for the salaries and expenses of an additional Forestry Officer required

[1] London: His Majesty's Stationery Office, 1918. Price, 3d.

on the staff of the Board of Agriculture for Scotland for the preparation of schemes.

"The Commissioners have continued to press the adoption in Ireland of their proposals for the afforestation of privately-owned land. The Department of Agriculture addressed enquiries to such Irish landowners as they considered would be likely to adopt the proposals, and as a result various provisional offers of land for the purpose were made.

"The Commissioners suggested that the Department should consider the suitability of the areas for schemes of economic forestry, and submit definite proposals in respect of those areas for which the Department is prepared to frame and carry out schemes. The Department is proceeding to give effect to this suggestion, and has informed the Commissioners that about 10,000 acres have been cleared during the last four years on private estates and on the Department's forestry lands, and may be regarded as available for emergency afforestation after the war. The Department has 750,000 seedlings in hand. In addition there will be the product of the sowings in the season of 1918.

"Representatives of the Commissioners visited Ireland in September 1917, for the purpose of inspecting land suitable for afforestation and the results of work already being financed from the Development Fund.

"A further matter of importance, to which the Commissioners have given attention, is the provision of nursery stock in case there should be a deficiency when the war is over, and planting operations on a large scale will become imperative. The grants recommended for this purpose are mentioned below. At the close of the year the Commissioners had just received and were considering a provisional application for a grant required for the purchase of additional seed for use by the three Agricultural Departments responsible for the carrying out of State forestry schemes in the United Kingdom. For this purpose a recommendation, which fell outside the year now under review, was made for a grant of £4400.

2. England and Wales.

"A grant of £5000 to the Board of Agriculture and Fisheries was recommended for the continuation in the year 1918-19 of the scheme for research, forestry instruction and advisory work

at four centres in England and Wales, minor forestry experiments and surveys.

"Application was made by the Board for a grant of £1500 from the Development Fund with a view to the formation of a statistical section in the Board's Forestry Branch to collect and correlate the data afforded by the fellings which are now taking place. The Commissioners were in complete agreement with the Board as to the importance and urgency of securing and analysing the information with a view to afforestation after the war, but it did not appear to them that the constitution of a statistical section at the Board for this purpose was an object properly to be charged upon the Development Fund. The Commissioners have in their recommendations upon such cases adopted the principle that payment for additional staff in a Government Department should only be defrayed from the Fund, instead of from the ordinary Vote of the Department, in cases where the necessity for such additional staff arises out of some scheme of development which is being conducted in connection with the Fund. In the present case, although the work contemplated was of an emergency character, and the grant for the statistical section was in the first instance only asked for six months, the Commissioners were unable to find that the proposed section differed essentially from the ordinary staff of the Board's Forestry Branch, the collection of data as to the growth of timber being part of the normal work of a Forestry Department.

"The Commissioners have continued to give attention to the provision of forest tree seedlings in case there may be a shortage after the war, when replanting on a large scale will be imperative, having regard particularly to the extensive areas of timber which have been felled during the war. Grants to the Board of Agriculture and Fisheries and the Commissioners of Woods for the provision of nursery stock have been made from the Development Fund during the past three years, and it is estimated that 40,000,000 seedlings were produced by the close of the 1917 season. About one-third of the total growing stock is immediately available for the afforestation of some 5000 or 6000 acres. An application was received from the Commissioners of Woods for a grant of £6905, in order to meet expenditure in the year 1917-18. It was arranged to line out all the seedlings, raised both by the Commissioners of Woods and

the Board of Agriculture, in nurseries under the control of the Commissioners of Woods, who will in future undertake the whole of the operations in connection with the raising by the State of emergency plants in England and Wales. The grant applied for was recommended.

"A grant of £200 was also made to the Commissioners of Woods towards the cost of the maintenance during 1917-18 of the Forest of Dean Demonstration Area, on the condition that the Land Revenues of the Crown continue as hitherto to bear the cost of general improvements and maintenance of Dean Forest and adjoining woodlands.

3. Scotland.

"The following grants to the Board of Agriculture were recommended:—

"(1) £2000 for each of the financial years 1917-18 and 1918-19 to meet expenditure on the extension of State Forest Nurseries in Scotland, with a view to the provision of plants for afforestation when the war is over. About 4,500,000 seedlings had been produced by the close of the 1917 season, mainly by means of grants from the Development Fund.

"(2) £1000 to meet expenditure in the year 1917-18 in connection with (*a*) preliminary arrangements for leasing or other proposals for the afforestation of privately-owned land in Scotland, and (*b*) survey work.

"(3) £2000 for the year 1918-19 to meet the salaries and expenses of three Forestry Officers for advisory, survey and research work, one at each of the three Scottish Agricultural Colleges. This grant includes provision for the cost of survey work and the preparation of afforestation schemes.

"(4) £930 to meet, for the period 1st December 1917 to 31st March 1919, the salary and expenses of an additional Forestry Officer to the staff of the Board of Agriculture. The Commissioners were informed that the Secretary for Scotland, looking in particular to the felling of Scottish forests during the war, was satisfied that Scotland was ripe for definite afforestation schemes. The Board stated that they were anxious to prepare schemes to be in readiness for planting operations when the war is over, and that the appointment of an additional officer to the Board's staff for this purpose was essential. The Commissioners

readily recommended the grant, as they consider that the preparation of afforestation schemes is of urgent national importance.

"An application was received from the Board of Agriculture for a grant in aid of the capital cost and maintenance charges of a proposed School of Forestry in Central Scotland. The Commissioners were sympathetic with the proposal, but under existing circumstances were not prepared to recommend the advance. In order that they might be in a position to consider the scheme in definite shape they asked the Board to inform them when the locality for the school had been provisionally chosen, and the Board was in a position to give further particulars of the scheme.

4. IRELAND.

"The following grants were recommended:—

"(1) £1517 for the year 1918-19 to meet the salaries and expenses of the Department of Agriculture's central forestry staff, whose appointment was made in connection with work financed from the Development Fund.

"(2) £1720 for the year 1918-19 to meet the cost of forestry work in Ireland financed from the Development Fund, and concentrated at the following three areas, viz. Ballyhoura, Co. Cork; Slieve Bloom, Queen's County; and Aughrim-Glendalough, Co. Wicklow.

"(3) £109 to meet excess expenditure during 1915-16 on the working of the Slieve Bloom and Glendalough-Aughrim afforestation areas.

"(4) £100 for the expenses during 1917-18 of a Forestry Inspector from the Department whilst engaged on a joint survey with officers from the English and Scotch Boards of Agriculture. The primary object of the survey party, whose purpose was to work in selected areas in the United Kingdom, was to standardise methods of survey so far as this could be effected by associating Forestry Officers from the three Departments of Agriculture in the same survey, and at the same time to map out a considerable area of land suitable for afforestation."

10. A Note on the Re-sowing of the Pine Areas in the Forests of Brotonne and Rouvray.

By Captain H. D. Hopkinson.

In return for being permitted to clear-cut large areas of pine in the above-named forests, it was agreed, at the request of the French Forest Authorities, that the British Army should re-sow with Scots pine seed the areas felled.

Sowing commenced in 1918, and in the spring of that year 146 acres were sown in the forest of Brotonne and 160 acres in the forest of Rouvray. The soil generally speaking is sandy in both cases, and in Brotonne there is a large admixture of flints which in places impeded the preparation of the "pits." The "pits" were made at the rate of 2420 per acre, and consisted of areas 1 foot square, which were cultivated to a depth of 6 inches; where turf existed this was thrown aside. The "pits" were made during the winter, and the sowing (in Brotonne) commenced on the 1st April and finished on the 23rd of that month.[1]

Procedure of Sowing.—The pits were first raked over, and then stamped, giving two lines about half an inch deep by half an inch wide in which the seed was sown. The pits were again raked over and the process was then complete. The quantity of seed sown was 4 lbs. per acre, which equals about 100 seeds per pit. Seeds were not soaked previous to sowing, or treated with red lead, except in a small experimental patch in which soaked seeds were sown. These, as was expected, germinated earlier, but otherwise did not, on the whole, do better than the unsoaked seed. This was probably due to the very dry weather which lasted throughout May—the month following the sowing. The seed was of British origin, mostly coming from the North of Scotland, but there is no information as to the precautions taken in collecting, and as the seed was required in large quantities and urgently, the probability is that it was not well selected.[2] Small experiments were made in Brotonne

[1] The main sowing finished in April, but actually further sowing was done throughout May and up to 3rd June, and was productive except what was sown in the last few days.

[2] The principal supplies of Scots pine seed in Scotland come from the north, where the collectors have for many years taken special precautions to ensure that the seed is gathered in the best pine areas from trees of the highest type and quality. There is reason to believe that the seed referred to was collected in Deeside and Speyside, under those conditions.—Hon. Ed.

by extracting local seed, and these in every case produced stronger and healthier seedlings.

General Observations.—It may be expected, as far as can be seen at present, that the sowing operations will be a success on the whole, provided the young plants do not succumb to the heavy growth of weeds which exists. Bracken fern and bramble are the weeds most to be feared, and during the summer in the forest of Brotonne the growth of bracken was partially cut. In my opinion the areas could have been more surely and successfully re-afforested by the planting of strong, good-sized plants that could have withstood the weeds, but the French Forest Authorities desired the area to be sown. As the felling operations proceeded the stumps of the felled trees were barked, and then charred by burning the brushwood in heaps upon them.

These operations were carried out at the express request of the French Forest Officers with the object of minimising the risk of a rapid increase in the number of pine bark beetle (*Hylesinus piniperda*) and pine weevil (*Hylobius abietis*).

It is of interest to note that in the forest of Rouvray, where the pine bark beetle is a dangerous pest, considerable numbers of the larvæ of this insect were destroyed in barking some stumps of trees which had been felled a year previously. At the request of the French about four trees per acre of the old crop were left standing in the Brotonne areas, probably with the idea of assisting the sowing by natural seeding. These trees are rapidly being blown down. In connection with this, it may be of interest to record that, for experimental purposes, a small plot without preparation was sown broadcast with pine seed. The result was very unfavourable, there being practically no seedlings to be found on this area.

Labour. — Prisoner-of-war labour was employed, and the following tasks were done:—

Barking Stumps (done previous to felling)—15 to 16 trees per man per day.

Burning Stumps—10 to 15 stumps per man per day (including collecting brushwood, igniting and watching fires).

Preparation of Pits—250 pits per man per day.

Sowing—Gang of 20 men did 10,000 pits per day (9 men raking, 3 men stamping, 4 men sowing, and 4 men covering).

11. Note on the Planting of Poplars at Kininvie.

By Lt.-Col. A. S. Leslie.

[The following Note on the planting of poplars at Kininvie has been received from Lt.-Col. A. S. Leslie.

The cultivation of poplars for economic use is a subject that has been very much neglected in this country, the principal reasons for which are referred to in the Note. The article is of outstanding value, and its usefulness and reliability are assured by the careful consideration given to the question by the author himself, and the well-known experts whom he has consulted in connection with certain fundamental questions relative to the possibilities of poplars as economic forest crops.

The question is naturally still in an experimental stage, and the experiment which is being initiated by Lt.-Col. Leslie will be followed with great interest. It is only by such means that further progress can be obtained. Future success depends very intimately upon the way in which science and practice are brought to bear upon economic problems, and we venture to think that all will agree that Lt.-Col. Leslie has left very little to chance in organising the lines upon which this important experiment is to be conducted.—Hon. Ed.]

A Note on the planting of poplars here was submitted to one or two experts for advice, and the following summary embodies their views :—

1. The area proposed is probably suitable to the growth of poplars.

2. It is preferable to grow the poplars pure rather than in a mixture with other species (see Balfour, Henry, and Marion).

3. With regard to variety to be chosen opinions appear to be at variance.

Lt.-Col. F. R. S. Balfour recommends, without hesitation, *Populus trichocarpa* of British Columbia, and gives particulars as to its rapid growth, viz. 6 feet branch cuttings, 2 years old, attained the following average dimensions :—

	Height.	Circumference at 4 feet.
In 8 years . .	30 feet	18 inches.
In 10 years . .	40 feet	23 inches.

He states that in its native land it is the largest poplar in the world.

Professor Henry recommends black Italian poplar (*Populus serotina*), but the figures he quotes as to its growth are not remarkable, and in an excerpt from an article to be published by him shortly he does not appear to be enthusiastic about growing poplars on land capable of growing conifers successfully.

He mentions the following hybrid poplars, but states that they have not been extensively tried :—

(1) Eucalyptus Poplar, *Populus regenerata*—similar to black Italian.
(2) *Populus Eugenei*—rapid at Kew.
(3) *Populus robusta*—probably wind resisting.

Mr E. R. Pratt recommends the above hybrids (1), (2) and (3), in preference to *P. trichocarpa*.

Mr J. A. Duthie, of Messrs Ben. Reid & Co., recommends black Italian poplar in preference to *P. trichocarpa*—he admits the remarkably quick growth of the latter, but states that the former produces better timber.

M. Marion in his *Petit Manuel* furnishes a new list of names, viz. *P. alba*, *P. canescens*, *P. nigra*, *P. angulata*, *P. monilifera*. He dwells particularly on the *P. monilifera*, and states that it is identical with the Peuplier Suisse, Peuplier Canadien, and Peuplier Virginie, and originates in North America. He distinguishes it from the Italian poplar, which till now has been most frequently planted, and states it is more frost-resisting than the latter and will take its place. He further relates how, by selective cultivation, he has created a super-excellent variety of this poplar, which on account of its quick growth he has christened Peuplier Suisse Eucalyptus Sarcé.

He gives the following particulars of growth :—

	Height of Marketable Timber	Circumference at 1 m. 30	Cubic contents measured *au cinquième*	Value estimated at
				Frs.
At 5 years	9 metres (30 ft.)	0 m. 50	0 m. 090	1.80
,, 10 ,,	12 ,, (40 ,,)	1 m. 0 (40 ins.)	0 m. 480	9.60
,, 15 ,,	15 ,, (50 ,,)	1 m. 40	1 m. 176	23.50
,, 20 ,,	19 ,, (63 ,,)	1 m. 80	2 m. 462	77.34
,, 25 ,,	22 ,, (73 ,,)	2 m. 00	3 m. 520	130.40
,, 27 ,,	28 ,, (93 ,,)	2 m. 20	5 m. 420	198.40
,, 30 ,,	32 ,, (107 ,,)	2 m. 30	6 m. 982	259.60

These figures show a more rapid girth-growth than the figures for *Populus trichocarpa* quoted by Lt.-Col. Balfour, but as the conditions are different the comparison must be taken with reserve. M. Marion distinguished two varieties of Peuplier Suisse Sarcé, the white and the red, but he recommends the latter as being of the more rapid growth, hardier and less exacting as to soil.

4. With regard to the method of raising the plants in the nursery.

Lt.-Col. Balfour has used 2-year-old branch cuttings kept in the nursery for two years, and planted out at 6 feet high.

Professor Henry advises keeping the cuttings in the nursery till rooted, and then planting them out. The cuttings should be from 4 to 6 feet long, and should remain one year in the nursery. Cuttings should be taken from stool shoots rather than from side branches.

M. Marion recommends either—

(1) Large cuttings planted out at a depth of 1 to 2 feet, or

(2) Rooted plants planted in pits.

Mr E. R. Pratt recommends planting at 10 to 20 feet high—the plants to be raised from 7-inch sets kept in the nursery for two years.

5. With regard to the method of forming plantations of poplars, M. Marion gives the following instructions:—

(1) Planting direct by slips or cuttings.

Date of planting—15th November to 1st May. The slips should be cut well in advance of planting, and kept in water—they may be kept in water from 15th November to the end of April.

The slips may be cut from trees in the nursery, and should be two to four years old—he does not give the dimensions.

The slips should be sharpened like pea stakes.

A hole should be made in the ground with an iron rod of smaller diameter than the slip.

The slip should be put into the hole to a depth of 18 inches.

No branches should be left on the slip.

Two men can plant 500 slips in a day—(presumably this does not cover cutting, sharpening, and transport from nursery).

This method is suitable for damp, peaty ground.

If the ground is not damp, the following procedure should be adopted:—Holes should be dug in the ground 40 inches wide and 2 to 2½ feet deep, and the slips should be planted in these holes as if they were rooted plants—the soil round the slip must afterwards be kept carefully weeded.

M. Marion states that planting by slips gives the best results.

Professor Henry, on the other hand, recommends planting rooted plants from the nursery.

(2) Planting of rooted plants.

Date of planting—15th November to end of April. Holes should be dug 40 inches wide, 2 to 2½ feet deep. The plants should, however, be planted only 18 inches deep.

The soil should be well broken up.

During the first few years the soil round the plant must be kept free of weeds or mulched with dead leaves or heather.

(3) Recommends planting 200 to 500 per hectare, say 100 to 200 per acre.

6. With regard to the subsequent treatment of plantations, M. Marion gives the following instructions:—

During the first few years all buds growing along the stem should be nipped off by hand in the month of June.

Pruning, *i.e.* the cutting of all side branches up to a certain height.

Lopping, *i.e.* the cutting of branches in the crown of the tree which threaten to destroy its equilibrium or to make double leaders.

Both pruning and lopping should be done between 15th November to 15th March—lopping is particularly necessary when the tree is young, in order to encourage the leader and to suppress all branches which might interfere with its upward growth.

After pruning, sprouts will grow from the edge of the wound, these must be removed in the month of August, and such sprouts will ultimately cease to develop—a pruning-hook can be used for these up to about 25 feet.

M. Marion considers lopping indispensable for the proper growth of the trees. He advises that pruning be carried out with great care, and that sufficient branches should be left to ensure full increment. The proportion he recommends is—for young trees three-fourths branched, one-fourth pruned, for larger trees one-half branched, one-half pruned.

M. Marion gives instructions as to the best way of protecting

young poplars from cattle, but to carry out these instructions would entail so much labour that it would probably be more economic in Scotland to keep cattle out of the plantations until the trees are large enough to resist them.

All suckers from the roots of poplar trees should be destroyed at once.

7. With regard to the economic value of poplar wood, the position in Scotland before the war seems to have been that its suitability for cart bottoms, wagon bottoms, and similar purposes where toughness is essential, was recognised, and purchasers were prepared to pay high prices for it. Owing, however, to the small quantities available and the irregular supply there was no free market, bargains were difficult to arrange, and consumers who would have used poplar if it had been available, had to fall back on less suitable substitutes, while producers were unable to find purchasers. This condition of affairs is likely to continue after the war unless poplars are planted extensively, in which case a regular market would come into existence automatically. If poplars are not planted generally throughout the country, the planting by a limited number of individuals should be done on a large scale, so that, even in the absence of a regular market, the isolated lots will be important enough to command special markets as they become mature.

The purposes for which poplar is likely to obtain a market, either general or special, in the future are indicated in the foregoing paragraph, and from experience during the present war. Under the latter head, Lt.-Col. Balfour states that Messrs Bryant and May have consulted him as to the feasibility of growing poplars in England for the manufacture of matches and match boxes. Their inquiry was due to the failure of supplies from Russia, owing to the war, and may, therefore, only indicate a temporary demand.[1]

[1] The utility of home-grown wood for many industrial purposes, from which it was excluded in pre-war days, has now been established, and the present opportunity must not be lost of establishing a constant market for home-grown timber in our wood-consuming industries. Otherwise, the demand created by the war will, of necessity, be of a temporary nature only. It is a matter of common knowledge that the important firm of Bryant & May are making provision to grow their own supplies of timber in this country. Now is the time when every effort should be made to provide future supplies of various sorts and kinds of timber suitable for the requirements of our different timber-consuming industries, in order that a home market and demand may be created on a permanent basis. —Hon. Ed.

Lt.-Col. Balfour also mentions the extensive use of poplar timber throughout Champagne for wine cases and cart bottoms.

M. Marion enumerates the following uses to which poplar is put — joinery, carpentry, paper pulp, matches, packing-cases, sawn timber generally, and plywood, for the last-named purpose its value seems likely to develop.

It must be borne in mind that for the majority of uses poplar will have to compete in Scotland with other species, the growing of which is general, and the commercial position of which is established. This handicap affects all newly introduced varieties, and often results in unremunerative prices having to be accepted until the position of the new variety has become recognised in the market.

An indirect advantage claimed for poplars is that they not only do no harm to pasture land, but actually improve it by giving shelter from early frosts, and improving the soil by their root action.

It would appear advisable not to embark on the planting of poplars as a regular crop, except—

(1) Where the land to be planted is incapable of growing profitable crops of well-established species, *e.g.* Scots pine, larch, spruce, Douglas fir, or even ash.

(2) Where poplar timber shows a tendency to acquire a higher value for special purposes (such as matches, plywood, etc.) than the better established varieties of timber.

(3) Where the land to be planted is of value for pasture.

(4) Where other proprietors are also planting sufficiently extensively to create a presumption that a free market will come into existence at a future date.

If this condition is absent it may be profitable to grow poplars if they are planted on a large enough scale to command a special market at maturity.

8. Information regarding existing sources from which poplar cuttings and rooted plants can be supplied, may be obtained from the trade.

9. In view of the differences of opinion expressed above as to the respective merits of different varieties and the best methods of cultivation, it is not proposed to plant poplars extensively at Kininvie until after an experimental trial.

For this purpose an area of 5 or 6 acres of suitable ground

will be taken, and planted partly with rooted plants, and partly with cuttings of the same size, at a distance apart of 16 feet or about 170 to the acre. It is clearly established that the trees for planting out should be as large as possible, and in order to obtain plants of the size required it appears essential that they should be grown from slips in a nursery on the spot. Otherwise, the cost of transportation from the grower would be out of proportion to the value of the plants.

Cuttings of the following species and varieties will be purchased in equal quantities :—

Peuplier Suisse	Eucalyptus Sarcé
P. trichocarpa	*P. Eugenei*
P. serotina	*P. regenerata*
P. robusta	

and will be planted in a temporary nursery close to the area to be planted. After two years in the nursery they will be planted out in the experimental plot. In order to get sturdy plants the cuttings should be stout, and not less than two years old—their length might be 2 to 3 feet.

The progress of the experimental plot will be observed, and if the experiment appears to be successful an adjoining area of about 40 acres will be planted with the species or varieties which have flourished best. The sets or cuttings required for this will probably be procurable from the plants already established in the experimental plot, or from the stools left in the nursery when the cuttings for the experimental plot were taken. It will then be possible to plant out direct without passing the cuttings through the nursery stage.

The delay entailed in carrying out the foregoing policy need not be considered as a loss, for meantime the land to be planted is yielding a rent for pasture, and there is plenty of other planting to be done on the estate.

NOTES AND QUERIES.

The Great War.

The Society's Roll of Honour.

Eighth List.[1]

Breminer, John, Clerk of Works, Balmoral Castle. 2nd Lieut., R.A.F.

Doull, Donald. Private, 2nd Argyll & Sutherland Highlanders.

Fraser-Tytler, Major Neil, D.S.O., of Aldowrie. R.H.A.

M'Kay, John B., Edinburgh. Captain, 4th K.O.S.B.

Prior-Wandesforde, Capt. R. H., of Castlecomer. R.F.A.

Stewart, Peter, Benmore, Kilmun. Sapper, 76th Field Coy., R.E.

[1] For First, Second, Third, Fourth, Fifth, Sixth, and Seventh Lists see Vol. xxix. p. 192, Vol. xxx. pp. 47 and 129, Vol. xxxi. pp. 66 and 168, Vol. xxxii. pp. 97 and 203, respectively.

Collection of Statistics.

The Interim Forest Authority has indicated to the Society that it would be glad to have the assistance of the members in completing the statistical work which the Board of Agriculture and Fisheries in England and Wales, and the Timber Supply Department in Scotland have been carrying on. The work is proceeding on uniform lines in England and Wales, Scotland and Ireland, and its objects are broadly twofold—

(1) To determine the timber-producing capacity of the various types of land which are now under woodland or may be available for afforestation.

(2) To determine the quality of the timber which may be grown.

The attainment of the first object is being sought by measuring on a set plan plots of growing timber (chiefly conifers), and several hundred plots have already been dealt with. As regards the second object, timber samples are being collected and tested.

It is intended to publish the results of these investigations in due course. The publications will probably take the form of a series of bulletins dealing with—

(1) The individual species.

(2) The silvicultural characteristics of different districts.

With regard to the individual species it is proposed to deal, in addition to statistics as to rate of growth, with such subjects as botanical characteristics, methods of propagation, formation of plantations and their treatment, timber physics, economics and production, utilisation of timber, insect and fungus pests.

Members of the Royal Scottish Arboricultural Society will be able to render great help, in the first place, by continuing to give facilities for statistical parties to enter their woods for measuring plots and felling sample trees; and, in the second place, by supplying information as to their experiences in forming and treating plantations.

It is hoped that a ready response will be given to this appeal.

Members could help by supplying information as to the woods which they believe would give interesting and valuable figures as to density, volume, and height.

It is also highly desirable to have statistics relating to the suitability of the more rapidly-growing conifers. It is believed that in many parts of the country a large stock of pit-wood could be produced in a short space of time by the selection of suitable species of rapid growth, and valuable information could be obtained from measurements of already existing plantations, which have arrived at or are approaching a utilisable age.

On Nurse Trees in Young Plantations.

In reading Colonel Stirling's interesting article (No. 15 in *Transactions* for July 1918) on the value of providing proper nurses for hardwoods, I am reminded of a conversation I once had with an experienced practical forester (Mr Doig, head forester at the time at Thoresby, Notts) regarding the importance of providing proper nurses for oaks.

He related how he had just felled two plantations of mature oaks of equal ages. In plantation A the oaks had been planted with nurses (Spanish chestnut); in plantation B the precaution of providing nurses had been neglected, and the oak timber was all "shaken." Result: the oaks in plantation A were sold at 2s. 6d. per cubic foot, while in plantation B the price per cubic foot was less than 6d.

This was a good many years ago, but as it seemed a lesson worth remembering I made a careful note of the facts at the time.

Hugh Shaw Stewart.

A Giant Elm (*Ulmus campestris*).

(*With Plate.*)

The following particulars, and the accompanying photo, of a remarkable tree felled in October 1918, on Bicton Farm, Rolle Estate, East Budleigh, Devon, the property of the Right Hon. Lord Clinton, may be of interest to silviculturists generally, and particularly to members of the Royal Scottish Arboricultural Society :—

Age, at least	270 years.
Height	107 ft.
Circumference 5 feet from butt . .	22 ft. 8 ins.
Contents	1012 cub. ft.

15 per cent. of volume deducted for bark.

Several huge limbs had formerly been broken off, which must have contained from 150 to 200 cubic feet, but these are not included in the present measurements. This tree, which was growing in an open field, shows to a remarkable degree the retarding effects of severe pruning on the growth of the tree.

The normal rate of growth was 6 years to measure 1 inch of radius, but after being pruned at

18	yrs. old, it took	10	yrs.' growth to measure	$\frac{1}{4}$	-inch radius.
43	,,	10	,,	$\frac{1}{2}$	,,
57	,,	5	,,	$\frac{1}{4}$	,,
73	,,	3	,,	$\frac{1}{8}$	,,
93	,,	6	,,	$\frac{1}{4}$	,,
104	,,	6	,,	$\frac{1}{4}$	,,
122	,,	5	,,	$\frac{1}{4}$	,,
142	,,	20	,,	$\frac{3}{4}$	,,

Between these, and after the last-mentioned date, growth went on at normal rate, which leads me to believe that latterly pruning must have been performed at shorter periods, and therefore much smaller branches had been cut off. The pruning here referred to means the trimming up of the bole of tree, as practised on hedgerow timber in Devon. The observations as to pruning were made 15 feet from the butt.

J. Milne (forester).

Giant Elm at East Budleigh, Devon.

[*To face p.* 80.

Large Wych Elm (*Ulmus montana*) at Dalkeith—blown down in November 1918.

A Scotch or Wych Elm standing in Lugton Haugh, Dalkeith Park, was blown down recently, and the measurements of the tree may be of some interest. The tree has been said to be the largest of its species in Scotland. It is to all appearances quite sound, although it has not yet been cut off at the root. The root cut is 40 feet in length to the first limb, and measures 35½ inches quarter-girth over bark at the centre of the log containing 350 cubic feet. The remainder of the main stem measured into sections contains 124 cubic feet, and three of the principal limbs contain 117 cubic feet. The smaller limbs at a moderate estimate contain 50 cubic feet. The total cubic content of the tree is thus 641 cubic feet. The circumference of the tree at the butt is 15 feet. It will be interesting to know whether any tree of this species of larger dimensions is known to members of the Society. J. H. Milne Home.

Preventive Methods against attacks of the Pine Weevil.

Text books on forest protection in referring to the attacks of pine weevil on young trees, advise, quite properly, the burning of all rubbish and branchwood over the cut stumps on newly-felled areas, and, where possible, the peeling of the stumps of coniferous trees. The burning of branchwood is as a rule attended to, although the operation is very often deferred until too late. The peeling of the stumps which form the breeding ground for the larvæ of the weevil seldom receives attention.

On two felling areas of 40 acres and 25 acres respectively, where there was reason to fear a serious attack on the young plants, the precaution was taken in the months of April and May 1918 to strip the bark from the stumps of both Scots pine and spruce. On the 40-acre area the trees felled had been mostly of large size, but on the 25-acre area the trees were of pit-wood size. In both instances very large numbers of larvæ were found, upwards of 150 being got in one large stump of Scots pine. Many thousands were taken out and killed on the two areas. There can be no question that if the stumps had remained unpeeled practically the whole of the young plants used in re-stocking the ground

would have been destroyed. The work was mainly done by women and boys, the stumps being stripped of bark to a point well below the surface of the ground. The cost was moderate, probably not exceeding 2s. 6d. or 3s. per acre. The damage done by weevil during the succeeding summer months was negligible, the pest being entirely under control.

It is evident from this experiment that the removal of the larvæ from the stumps where an attack is expected can be undertaken at moderate cost, and thus the delay of several years in replanting is avoided, as well as the loss of rental and the deterioration in the surface condition of the soil which invariably follow where a cut-over area is left unstocked for a period of years. J. H. Milne Home.

The Uprooting of Trees.

(*With Diagram.*)

The attached rough sketch shows the method employed at our Kirriemuir Company for removing the trees on the right-of-way of the light railroad.

The equipment consists of a 75-horse-power donkey engine, an inch main line steel cable, and an inch haul-back cable. The diagram gives a very fair idea of how the system works out. In the first instance, the main strain is taken on what is known as the lead tree, which is strengthened by being stayed by a guy fastened to two trees close by. At the end of the main cable there is a swivel, to which is attached a tag line. The tree which is to be felled is snubbed about 7 feet from the ground with a choker line, which in turn is hooked on to the tag line. The swivel is important in order that no twist may be possible on the main line. The haul-back line is fastened to the main line cable on the swivel by means of scissor hooks.

The felling commenced at the end nearest the engine. Each tree as it was pulled down was limbed and cross cut, the main cable being then pulled to the next tree by means of the haul-back cable. No easing or cutting of the roots was found necessary.

I trust that the above information will be sufficient to give an idea of the method. L. F. Strickford,

Captain, for D.A.D.T.O.,
Canadian Forestry Corps.

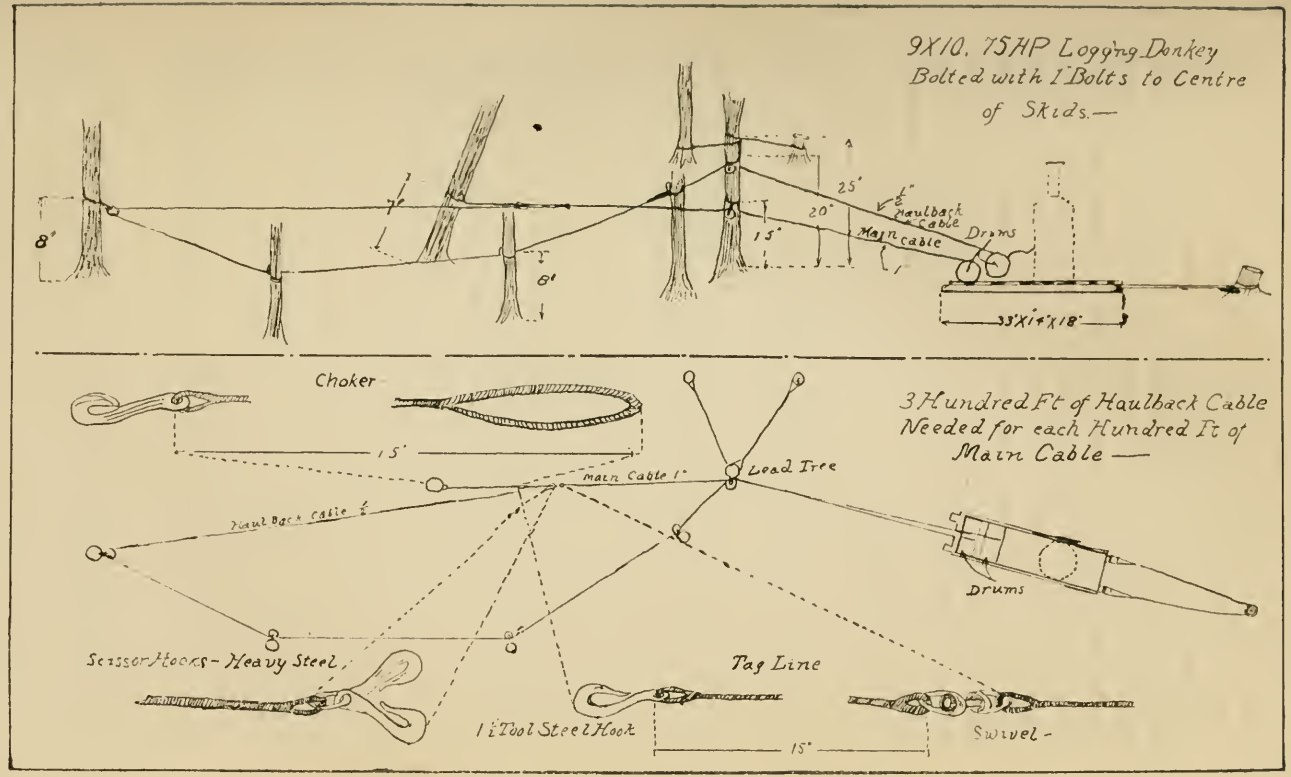

DIAGRAM TO ILLUSTRATE METHOD OF UPROOTING TREES.

The Importance of Pruning.

While visiting saw-mills in different districts of Scotland for the purpose of collecting specimens of timber for testing purposes, I had a good opportunity of noticing the effects of different soils and situations upon the growth of various species of trees. The result of these observations cannot be fully chronicled until after the tests are made. One point was, however, driven home to me, upon which I should like at once to express an opinion, and that is, the large percentage of timber that was spoilt, or its value greatly reduced, by the presence of big, black, rotten knots. Undoubtedly this has been due, in the first place, to the open nature of the woods.

There are various reasons for this fault, viz.—(1) The trees may have been planted too far apart. (2) Thinning in the early stages had been too severe, and made either for the purpose of improving the plantations for game or for providing material for estate purposes (when usually the best trees are taken). (3) A bad mixture may have been planted, and one or more species had been suppressed or killed out, leaving the dominant trees too far apart. (4) Damage by ground game, insects, fungi, etc., may have thinned the crop.

All of these faults would result in branchy trees, and by the time close canopy had been formed, the branches would be too big and strong to rot off quickly and allow proper occlusion to take place. Year by year the trees would increase in girth, growing round the rotting stump, instead of growing over the smaller wound that would have been left had the branch been killed off at an earlier stage.

It is a big fault to allow trees to grow very branchy, but it is a worse fault to leave those branches on after they are dead, especially when they are very persistent, as in spruce, Douglas fir, or Scots pine. Even in a plantation where the density is good, dead branches will still adhere to the stems for several years after they die, and my point is that these should be pruned off if we are to grow clean timber able to compete with the best from other countries.

Trees will grow as well in our climate as on the Continent, and I have seen planks sawn from spruce grown in Scotland, which an expert would have difficulty in detecting from the best Norwegian. This, however, is an exception, but there is no

reason why it should be if we give the trees a proper chance. We make a point (more often in text-books than in practice, I am afraid) of thinning regularly every five years or so, and we should do the same with pruning. It could be done at the same time as the thinnings, and the expense incurred would be repaid by the better price which would be given for clean timber. At some of the saw-mills it was very difficult to get four pieces of timber (from the same root cut), measuring 6 ft. × $3\frac{1}{4}$ ins. × $2\frac{1}{4}$ ins., free from knots larger than $\frac{1}{2}$-inch diameter. In some places it was impossible, the knots being usually big and rotten. Trees often 100 to 120 years old, and from 20 to 28 ins. in diameter at 4 feet, had rotten knots reaching from near the centre to the outside. This refers particularly to the Scots pine, the larch and spruce knots being usually much sounder. If these branches had been pruned when they died, say, when the trees were from 20 to 40 years old (according to the height of the branches), the small knots would have been sound, and the timber put on after that age totally free from knots.

It is possible that situation and climatic conditions may affect dead branches, as, on the whole, the woods in the centre and north of Scotland were found to be freer from rotten knots than those in the south-east and east, but, with all due respect to those who were in charge of the woods in their younger stages, I think it is mostly a question of management. There are thousands of acres of young plantations in the pole stage left in the country, and it will be a great pity if these are allowed to grow knotty timber for the want of a little time and money spent upon pruning.

On some estates systematic pruning is carried out, and the result is very pleasing. Quite recently I saw a Douglas fir plantation, 25 years planted, that was pruned about 10 years ago for the first time, and again since. The trees were long and straight, and already the trunks look as if they never had had branches growing upon them. The exceptional price realised for this plantation more than repaid the cost of the labour (even allowing for war-time prices).

I am not a believer in pruning live branches, especially those of conifers, but where dead branches are persistent they must be pruned off as soon as possible after they die. First of all, kill the side branches by close planting and keeping close canopy, and after that assist nature with the pruning-saw. Our

home-grown timber will then compete on more equal footing with that imported from the Continent or America.

W. H. Whellens.

Band Saws *v.* Circular Saws.

In connection with saw-mills, it is very noticeable how much time is wasted where the timber is large (say over 24 ins. diameter at 4 ft.) in axing through that portion of the butt not touched by the saw. Most of the mills observed were using what had originally been 5 ft. 6 in. circular saws. A new saw of that diameter will only cut about 2 feet on our Scottish benches, and the constant filing soon makes an appreciable difference to the depth that they will cut.

This is obviated by the use of the inserted chisel-tooth saw used by the Canadians, but these take a very wide cut. On a big stick, it is often a difficulty to get the saw through without a stop, or without heating or buckling the saw. After the saw is through, that width of the tree that the saw has not touched must be axed through, or the log turned and sawn from the other side. The latter method means heavy lifting and straining, unless a crane is used; by both methods time is lost. (*Note.*—A crane should be erected at all mills where the timber is heavy, for use in unloading carts and for feeding the saw bench. Time would be saved, and the strain on the men would be much less. They would, consequently, be fresher for the actual work of sawing. For use in loading the carts or bogies in the woods the tripod with pulley-blocks should be more used in Scotland. All heavy lifting is then avoided.) To do away with the axing or turning, more use should be made of upright band saws for breaking up timber where the operations are large enough to warrant their erection, or in stationary saw-mills. The time saved alone would repay the cost of erection, without taking into account the saving of timber which would result from using this type of saw. They are usually thinner than the large circular saws, the waste in sawdust, consequently, being less. The depth of cut is much greater than that of the circular, and to increase the diameter of the latter also means an increase in the width of cut.

Personally, I think that the ideal mill is one fitted with a

band saw for breaking up the timber, and with live rollers to convey the larger sawn material to a circular saw with fence, and the slabs from these two saws to another circular for manufacturing the smaller classes of material.

W. H. Whellens.

Coppice Standards.

I heard a statement a short time ago to the effect that "standards in coppice were left for the express purpose of growing crooked timber for ship-building." So far as my experience teaches me, those that left standards for that purpose would defeat their own ends both as regards the crooked timber and the growing of coppice.

In selecting poles to be left as standards, the straightest and lightest topped ones were selected. This is not only modern experience, but also that gained from the old coppice cutters; men with no knowledge of systematic forestry, but who always had left the best poles and had learned to do so from their fathers before them. They may not have been able to say why they left the best poles, but it certainly, on the face of it, would not be to grow crooked timber. The good poles that were left were soon again surrounded by the young coppice which would crowd upon them and suppress any side shoots to nearly the height they would attain at the end of a rotation of twenty to twenty-five years. The branches above that height would certainly have more freedom for development, but unless the owner of the coppice wanted to have it killed out, he would keep them within bounds by pruning (instances of which are to be seen on standards of all ages in our coppice woods). Years ago, young coppice had a ready sale and would yield a return much higher than that from the thinly scattered crop of standards, and it would be poor policy to kill the goose that laid the golden eggs. The larger branches may have been and undoubtedly were used for boatbuilding, but to say the trees were left for that purpose is, in my opinion, very wide of the mark.

The result would have been better if a very thin crop of trees had been planted and allowed to grow unheeded, but to start from coppice stores would be to lose twenty-five years or so before the trees were even allowed to start side branches. In

very few high-woods of oak, ash or elm can such clean butts up to 25 feet be found as among the standards in coppice woods. The standards being specially selected trees, of good form, and grown under favourable conditions, the timber is very clean and easily worked. W. H. WHELLENS.

THE DESTRUCTION OF YOUNG PLANTATIONS BY SQUIRRELS.

The following letter has been received by the Secretary from Mr James Grant, Head Forester, Novar, and was submitted to a meeting of the Council. The members agreed that the question was one of great importance, and gave instructions that the letter should be printed in the *Transactions*. The letter is as follows:—

"Since the older fir plantations have been felled, the squirrels have lost their accustomed places of refuge, and they are now attacking the young plantations of ten years old and upwards. Squirrel damage is a serious matter, and probably you may be going to discuss this at one of your meetings. The number of squirrels killed in Novar woods alone was 200 for the year. To encourage the keeping down of the animals, Sir Ronald Munro Ferguson has been paying the keepers 4d. per tail, and this has been done for many years. During the war so many keepers were called up for service, that squirrels have been allowed to increase in numbers to a serious and dangerous extent. Some steps should be taken at once to keep down these destructive pests, if the younger plantations are to be saved from destruction. Should you bring this before one of your meetings, I shall be glad to know what steps are recommended."

A NOTE ON PLANTING AND SOWING.

Foresters, and those to whom forestry was formerly nothing more than a word, are now alike in stating that re-afforestation must take place on a large scale to make up the ravages of war on our woodlands. Undoubtedly the first thing to be done will be to re-establish trees on the sites of old forests. But it is hoped that this will not be the limit of our afforestation efforts, and that new land will be taken for tree culture.

The question of initial costs must always be kept in mind along with the silvicultural efficiency of the work. This efficiency is obtained by having the right number of the right species of plants on the ground at all stages of the forest's existence. To obtain the proper number of trees at the beginning entails the outlay of capital at the most expensive period in the whole rotation. In attempting to reduce this initial outlay one must consider all possible ways and means of establishing the new crop.

In Britain, planting has usually been practised in preference to sowing. By this method there is an early show of stocking. In addition, the young trees are sooner out of the way of various dangers than are those established by sowing. The costs of planting may exceed those of sowing. This will entirely depend on the cultural operations necessary in each case.

M. L. Boppé gives the following résumé of the question :—

"It is better to plant than to sow :

"1. On soft ground; on ground which readily heaves with frost; or which is covered with grass; and in elevated stations where the climate is uncongenial.

"2. In places where the seeds are in danger of being devoured by animals.

"3. In dry, warm climates where the roots would have to pierce rather deeply in order to withstand a life of insolation and periods of prolonged drought.

"In general, with planting one can produce more easily than with sowing the desired consistency of stocking and mixing of the species.

"Lastly, one can see and repair failures more easily.

"Sowing is to be preferred to planting :

"1. In certain stony soils where planting would be difficult.

"2. When seed can be obtained at a very low price.

"3. When the ground requires no particular preparation for sowing.

"In all other cases sowing costs more than planting.

"One of the principal inconveniences of sowing is that the plants tend to be too numerous in one place, and it is necessary to thin them out early, especially if they are conifers. This work, always delicate, occasions an increase in expenditure which must be taken note of."

M. Boppé then states that all means are good if one knows how to use them. There is no question that where sowings can be made successfully without much previous cultural preparation, it is much cheaper than planting. In order to reduce initial costs a sharp outlook should be kept for all areas suitable for sowings. Unfortunately, however, they will be few in Britain, but this note is given to assist in finding and utilising those few places. J. M. M.

REVIEW.

Afforestation. By JOHN BOYD. W. & R. Chambers, Ltd. 1s. net.

Mr Boyd is well known to all Scottish foresters as the Crown Forester at Inverliever, but he is careful to state that the work under consideration is in no way official or inspired. It is merely a statement of his own private opinions and experience. Mr Boyd is a practical forester of no small repute and we welcome works from all such men; but this book need not be considered on that score alone, since it is brimful of common-sense and patriotic views on forestry.

The first part appeared from time to time as articles in the *Glasgow Herald*, and gives good sound reasons for the advancement of forestry in Britain. Many interesting statements and suggestions are made. One is then led through the sequence of considerations from the advisability of planting to the choice of plants for various soils and situations. Here, the author places at the disposal of the reader some of his abundant experience in this work. He indicates that the most satisfactory way of selecting species for any area should be based on the natural flora of the ground. This method is undoubtedly the best that can be adopted where actual tree results are lacking, and it is worthy of considerable study in Britain. Mr Boyd's practical experience in this matter is worthy of careful study. At the same time, his warning that the results stated refer particularly to west coast conditions should be heeded. Possibly they may hold elsewhere, but our present knowledge is not sufficient to admit of definite statements.

This little work should be in the hands of all interested in afforestation.

OBITUARY.

Dr Johann Coaz.

The members of the Royal Scottish Arboricultural Society will learn with deep regret that Dr Johann Coaz, Chief Forest Inspector in Switzerland, passed away after a short illness at Chur last August, in his ninety-seventh year. All members of the Society who took part in the excursion to Switzerland in 1913 will remember the great interest Dr Coaz took in the Society, and the excellent arrangements he made to ensure the success of the visit. Dr Coaz devoted his life to the development and improvement of forestry in Switzerland, and during his long connection with the Forest Service he saw many great improvements carried out under his direction and supervision.

His many contributions to forest literature are of outstanding merit and importance. The Society's library was enriched by a gift of numerous books, papers on original research, and reports made by Dr Coaz, after the conclusion of the Society's visit to Switzerland. All members of the Society, and foresters in every part of the world, will regret the loss of one who had laboured for so many years to the benefit of forestry not only in his own country, but in all countries where this essential industry exists.

Mr John M'Laren.

The Society will regret the loss of the late Mr John M'Laren, who was Secretary of the Royal Scottish Arboricultural Society from 1879 until 1887. During his secretaryship, the first International Forestry Exhibition was held in 1884. The Exhibition was carried through successfully by him under the Presidency of the late Marquis of Lothian, who highly complimented him on the way he conducted the business and the constant attention that he gave to the enterprise, and for the excellent report which he compiled on the Exhibition.

During his tenure of office the late Mr M'Laren held a position in the North British and Mercantile Insurance Company. Mr M'Laren's father was woodland manager on the Hopetoun Estate, and was well known and very much sought after as valuator and reporter on the management of estate woodlands.

The late Mr M^cLaren had a kindly disposition, and was much esteemed by the Council and the members of the Society who came into contact with him. He was the founder and captain of the 3rd Edinburgh Company of the Boys' Brigade, in which he took the keenest possible interest, giving to its activities and to the welfare of the individuals composing it almost all his leisure time. A volunteer and an excellent shot in his younger days he was well qualified to train his company, which was represented in the war by no fewer than 531 "old boys."

Mr M^cLaren died in Kingussie on 7th August 1918, and was buried in Edinburgh.

Mr William Wilson.

We regret to record the death of Mr William Wilson, timber merchant, of Auchinleck, which took place very suddenly on 17th June 1918.

Mr Wilson, who became a member of the Society in 1899, was a native of Mauchline, but spent the greater part of his life in Auchinleck where his father took over the saw-mills in 1876. Under his guidance the business became one of the largest in Scotland, twelve saw-mills throughout the country being worked under his direct supervision. Mr Wilson was also at one time president of the Scottish Timber Association, and frequently acted as arbitrator in connection with timber disputes. He leaves a widow and six daughters, one of whom has been nursing in France.

TRANSACTIONS

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A. W. BORTHWICK, D.Sc.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

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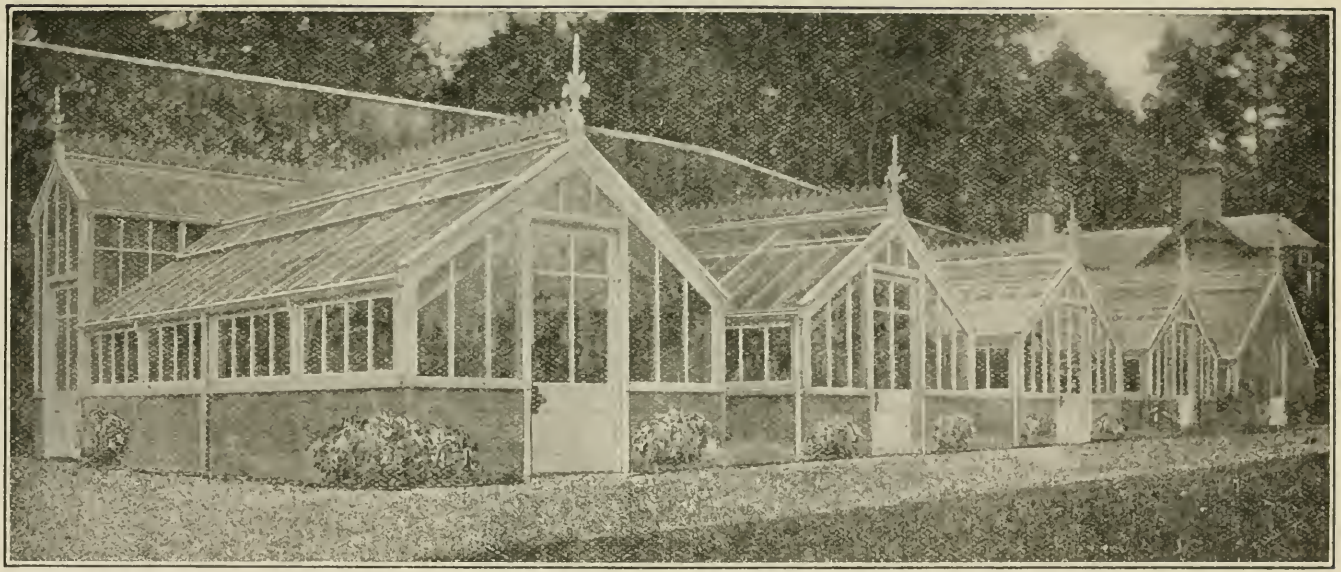

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4. Assistant-Foresters, Assistant-Gardeners, and **others**, subscribing annually . . . . . Four Shillings.

IV. Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.

V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums:—

1. Large Proprietors of land, and **others**, . . . £10 10 0
2. Small Proprietors, Factors, Nurserymen, Timber Merchants, and **others**, ... 5 5 0
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and **others**, ... 3 3 0

VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.

XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

8 Rutland Square, Edinburgh,
1st *July* 1919.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

12. Speeches by the Representatives of the Board of Agriculture for Scotland and the Interim Forest Authority at the Annual Meeting of the Society, held in Edinburgh on 8th February 1919.

After the formal business had been disposed of, the President called upon Colonel Sutherland, of the Board of Agriculture for Scotland, to address the meeting.

He said:—"My Lord Duke and gentlemen: It is not a very easy matter for me to address you with all the care that is necessary in official affairs, because I only arrived on Monday at the office in Edinburgh, and I have not been able to pick up all the strings of my work. I may say, however, that my friend and colleague, Sir Robert Greig, has been doing the work in my absence. I know it was a thankless task—it was a thankless one for me before I went away—but I have no doubt he has given all the attention that was possible to it with the assistance of my admirable colleague, Dr Borthwick. I think, although there was some complaint to-day in the general report of your Society, that probably there was a reason why you did not hear of the schemes that were suggested by the Board. One reason was that in the particular instance referred to—I think it was the property of Lord Shaw—I was informed by my colleague that the agreement had only just recently been adjusted. It has been the object, I believe, of a good deal of negotiation. I am not sure whether I will be at liberty to send you the terms of that agreement or not, but if I can I certainly will do so. I do not think in public transactions of the kind there ought to be any particular secrecy. I think that the chief point, and the point which involves us all as officials, is to gain your confidence and to tell you what we are doing.

"In connection with forestry I feel to-day we are in a very fortunate position. The Prime Minister has indicated that forestry is to take a real place in the reconstruction programme of the Government, and the Secretary for Scotland has also in many ways given you assurances of his real interest in this matter. Both of these statesmen well know the possibilities of their respective native countries for the creation of large forests, and I am quite convinced that there never was a time when there was a better opportunity to go ahead. It so happens, however, that the Government have not settled the lines of policy or the exact lines of administration. It is to be hoped that these will follow in a very short space of time, but in the meantime I personally, and I know you, welcome the creation of the Interim Forest Authority, and particularly my friend Colonel Fothringham who is here to-day as representing the Interim Forest Authority. I know that you have confidence in the constitution of that Authority. You have exhibited that confidence in various ways already, and I am quite sure your confidence will not be misplaced. I should explain that the Secretary for Scotland has asked me, as a member of the Board of Agriculture, to undertake the development of forestry in Scotland, and he has also requested me to co-operate with the Interim Forest Authority, and, so far as I can, my fullest co-operation in all the work will be given to the Authority.

"There are some matters that I would like to refer to just now because, as you know, we cannot expect large forests to grow in a day, and we have many things to do and many preparations to make before forestry becomes a real and assured and established industry of the State. In the first instance, we have got to find the ground. The Reconstruction Sub-Committee propose that 200,000 acres should be planted in the first ten years. To obtain that area of ground means exhaustive negotiations and a good deal of time. We must be particularly careful to select the right ground, and we must have the best advice in the selection of it. Now, we can only get the ground if we have the sympathetic consideration of the owners of it. You as an established Association for over sixty years have urged the advantages of afforestation. Your membership consists of all the large and, I think, of most of the small owners of land in Scotland, and I would ask these members and their

factors and their agents to help the Authority, and help myself for the Board, in every possible way in negotiating reasonable terms for the land that will be needed.

"If we can get along well in that direction we have still other things to contemplate. For example, we must train the men who are going to be employed in forestry. We have got a certain number of officers now in the army who have applied for work. Most of them will have to be trained, and if they intend to attain real utility in the higher branches of the service they must go through a good course of technical and scientific education. It will not be wise for them to be content with any limited or inefficient course, and while I am talking of that I would like to remind them and to remind you that the number of officers who will be wanted not only to-day but within the next ten years will be limited. In France, where the forest service is a very large and a very old one and where the reserves of forests are extensive, the total number of men in the higher branches of the service does not, I think, altogether exceed 400 or 450. It will be many years, probably fifty years, before 400, or even half that number perhaps, may be required in Scotland. Then, coming to the training of working foresters—the men who have been in the army or civilians who are going to take part in this work—the Authority and the Board have got to arrange for their education. They cannot plant without the men, and the men must have some knowledge of the method of planting. Thanks to the Duke of Atholl and Colonel Fothringham, a school has been established for the practical training of foresters at Birnam. That school is quite insufficient. We want it to be increased, and we also require other schools of the same kind. That subject has to be taken up by the Authority. Further, it is impossible to plant unless you have the plants and seeds. We have had a woefully bad sequence of seed years in the forests, and the result to-day, what with the war and all that it has meant to labour in this country, is that we are lamentably devoid of the necessary plants for the afforestation of the land. I would ask everyone who has got any opportunity of collecting cones, particularly of Scots pine and of larch, to do so with the utmost possible speed so that we may preserve all the seed we can possibly get in the country at present. I know it has been difficult to collect in the past, and I also know from experience elsewhere that the other countries

intending to plant after the war, such as France and America, are also in a very bad condition with regard to their seed reserve, and we cannot expect a great deal of seed from either of these countries for some little time. I think probably it would be a good thing to have a conference with the nurserymen in Scotland who have done so well in the past, and I personally, and I hope Colonel Fothringham too, will have a meeting with them with a view to endeavouring to increase the quantity of plants for next year and for the following years.

"Another matter that Dr Borthwick mentioned to me, and which I would like to refer to here, is the necessity for clearing up the ground which has been felled by Sir John Stirling Maxwell's Department and private owners. The neglect of that on the part of the Department has not probably been so great as the neglect of it elsewhere, where the timber has been taken by timber merchants who, in the rush for time, have not had the opportunity of doing all that would be done probably in the time of peace; but it is essential that as much of the brushwood as possible should be burned without delay, because not only does it affect the area that has to be replanted, but it creates a danger to all surrounding plantations. Sir John has been good enough in that connection—and I would be ungrateful if I did not thank him—to mention my association with the Timber Supply Department in Scotland, and I can assure you that all the statistics and all the information that will be prepared, and that you will ultimately receive, has been entirely the result of Sir John's own interest in forestry and in his Department. I take absolutely no credit for it, because in the early days of timber as a Department we had little time to devote to statistics.

"Now, one factor, and a pleasant one, in connection with afforestation to-day, is that we are really going to do something for the men who have gone away and who have risked not only their lives but their livelihood from purely patriotic motives. I mean there are hundreds, and probably thousands, of these men who have come back and are coming back either in bad health or in want of limbs, or in other ways disabled, who will benefit by afforestation, and I think you will join with me, and with every one connected with afforestation, in the hope that we will really do something towards the improvement of the condition of these men. They can do better work and can be more

healthy, and altogether have a pleasanter existence, if they get employment in the country than if they have to fall back on labour in the towns.

"A side of forestry I would like to refer to as the result of our experience elsewhere is this. The British Government had to buy enormous quantities of standing wood in France, and the Americans had to do the same. But we found that it was in many ways much easier to purchase in France than it was at home, and the reason for that was, when you dealt with a communal district you seldom or never negotiated with an individual owner of trees—you dealt with the Mayor of the Commune. The Mayor of the Commune represented all the interests in the Commune, and was a man in whom everybody placed a tremendous amount of confidence. One lot of trees which we purchased comprised between 80,000 and 90,000 trees, and when we came to have them all mapped out and subdivided, we found we were dealing with about 250 proprietors. Can you carry that home to Scotland? Where will you get 80,000 trees owned in one block by 250 different men? Some of these owners were possessed of five trees, others were possessed of ten, some of twenty, some of hundreds, and a very few of thousands. We, by the way, usually found that the Mayor was the man who possessed the largest number. But nevertheless they had confidence in him. Now, these men were not holders for life: they were not landholders with security of tenure. They were the real owners of the land, and that very small ownership in France has done much to inspire the interest in forestry. The fact that a man owned five trees gave him not only an interest in the trees and in watching them grow, but it gave him an interest in the soil that inspired him with the desire at the end of a few years not to own five trees but to own fifty. And so it is over there. France has created a national Department for afforestation. It has developed the industries that pertain to afforestation; it has done everything to help it, with the result that the people realise that when they work in the woods or when they have got anything in the nature of wood to sell, they are going to get the best price for it, and they are also doing something which is bringing to France additional revenue. Of all the patriots I have ever met, and of all the people to do things for their country first, I think the French may claim first place."

The President.—"We are much obliged to Colonel Sutherland. He sat down very suddenly, and I thought we were going to have some more. We have a great deal of confidence in him."

Colonel Fothringham, member of the Interim Forest Authority.—"My Lord Duke and gentlemen: I have come here from the Interim Forest Authority not because I have a great deal to say, but because the Interim Forest Authority, on their last visit to Edinburgh a short time ago, made a promise to this Society that they would keep in close touch with the Society, and they did not think that the Annual Meeting should be allowed to pass without some representative from the Authority being there. I think it was explained at that time, when several members of the Authority came to Edinburgh, that the Authority was purely interim. It is not perhaps altogether realised by a good many people, who expect that a great deal of work will some day be done and great responsibilities undertaken for the future, that this body is purely interim, and that it cannot commit any successor, any future body, which may be set up by legislation, to a great deal for the future. I hope, however, that it will not be very long before a permanent Authority is set up. You were good enough, in your proposed resolution, to make some reference to the Interim Authority, and it has done, and is doing, a certain amount of work, but it is necessarily very limited by the fact that it cannot make any commitments for the future. The Interim Authority cannot either own land or lease land or hold it in any shape or form, nor can it make appointments which would last beyond its own tenure of life, whatever that may be. It would be very difficult to try to get the best men to accept appointments under the Interim Authority if they had the idea that these appointments might finish in six months or a year or anything of that sort, and they would find themselves left without employment. That is one of the chief difficulties we are up against—that we cannot make appointments that are absolutely necessary for carrying out any big schemes. I am sure the Authority has your sympathy when the difficulty is pointed out.

"There are one or two matters in which the Authority has been able to make some little progress. Colonel Sutherland referred to the matter of schools. It has been considered within the limits of its powers to make inquiries, at any rate,

as to the best places where schools could be put up for woodmen, and how the education of forest officers might best be promoted. One school for the training of practical foresters in Scotland is, of course, quite inadequate for the needs of the country. The demand for practical foresters will probably necessitate the establishment of three or four schools. These might be situated in the north, south, east, or west, but wherever these schools are established they will be necessarily limited as regards the number of men they can accommodate, because it is impossible to have a school for teaching practical woodmen, unless there are sufficient existing woodlands to keep them employed. The choice of stations, therefore, for these schools is at present very limited. There must be a certain amount of woodland before you can keep a big squad of men employed, and those compact blocks of woodland are not very easily found in Scotland. Such as there were have been considerably eaten into, but I hope they will be re-planted, and that in itself would give employment for a considerable part of the year, at any rate, to the men who were learning forestry. They would get a thorough grounding in the necessary preliminary work and in the planting work of that particular district. These schools, I hope, will be set up before very long.

"Then, as regards the forest officers, a very large number of army officers have made application for instruction in forestry with a view to taking it up as a profession. Well, as Colonel Sutherland has told you, the number of appointments is very limited. The only advantage is there will be a big field to choose from, but the number of disappointed men will, I think, be very considerable. That, however, is not the fault of the Authority, because they did not either start the scheme of teaching these officers or make themselves in any way responsible for them. I hope, however, in the future the permanent Authority which will be set up will take the matter very seriously in hand, and see that a sufficient supply of forest officers thoroughly trained in all the scientific departments will be maintained in this country. There are openings, of course, for thoroughly trained forest officers, not only in State forests but in private forests, where they are sufficiently large to warrant the employment of a thoroughly trained head forest officer, and in all probability it will pay an estate well to employ the thoroughly trained man instead of the partially

trained man, or the man whose training is merely nothing more than his own observation, excellent though it may be.

"Another thing that the Interim Authority at the present moment is trying to start is a thorough investigation into the plagues that are besetting us in the shape of weevils and beetles. If any of you gentlemen have a plague of weevils and beetles in the woods that you administer—and I have little doubt you have—it would be a considerable help to the Authority if you would advise them of any plagues you have recently observed. It will be a help to the Authority to get notes from different parts of the country—the time when these plagues first appear after felling and the means taken to check them, if any, and the results of burning the brush and the top of the stools. All these are things which have been done in some cases I know, and if careful notes are kept and communicated to the Authority or to this Society they would be of very considerable help to future investigations and research.

"The question of seeds and cones Colonel Sutherland has already touched upon, and I may add that during the last few months, numbers of inquiries from nurserymen, not only in this country but abroad, have come under my notice. There is a very great shortage, but I think it likely that in a number of woods where felling is going on at the present time, if a careful lookout is kept, there will be found an appreciable amount of seed available for collection during this finishing winter and coming spring. There might be collected from the felled trees a considerable number of cones which would be of material assistance.

"I do not think, gentlemen, there is anything more I can say on behalf of the Authority at the present moment. There is really so very little scope for doing anything until the Authority is made permanent, but the Parliamentary Bill for making the Authority into a permanent one is in such an advanced state of preparation that I hope it will not be very long before it is brought into Parliament. The future of the Bill is, however, a matter entirely beyond the power of the Authority. All we can do is to get the Bill into a very forward state of preparation and pass it on to the Cabinet and the Government, and they in their turn will no doubt alter and revise it, if they think necessary, and will then introduce it into Parliament, but how long it may take to get it through Parliament is more than I or any other man

can tell you. But so long as this Interim Authority is in existence you may be sure it is the intention of every member of it to keep in close touch with the various Societies which represent the forestry industry in this country—this Society and the similar one in England, and the Land Agents' Society in England, and the Factors' Society in Scotland, and also the teaching centres, and that is about the most useful thing we can do at the present time."

The President. — "We are very much obliged to Colonel Fothringham. I think what he has said rather emphasises the necessity of the resolution which is now to be submitted to the meeting."

13. The Realisable Resources of the German Forests.[1]

I.

The long war from which we are emerging has terribly tried our French forests, formerly so rich and beautiful. The fellings made for the needs of the army, those made with incredible vandalism by the enemy in the parts he occupied, which were precisely the best wooded in the country, have impoverished and ruined them for a long period. As to the woods situated in the region of the front, there remains too often nothing but a mere vestige of them.

The damage done to our forests cannot immediately be restored by spending money. A house may be rebuilt, a factory can be provided again with the essentials in a few years; to reconstitute a forest there is required, not only money, but time. Our forests will not be re-established at their past degree of high value within a century.

This situation is the more disquieting because it is precisely at this moment, when the sources of wood production are so much reduced, that our needs have enormously increased. We have to rebuild our houses and to replace our furniture and appliances. It will be absolutely necessary to take from the forests of the enemy what we need, and which he owes us, to replace what the war has caused us to lose. My object is to

[1] Translated from an article by M. Huffel in the *Revue des Eaux et Forêts*.

work out, as far as possible, what the enemy's forest resources are, and how we may utilise them.

II.

From official statistics of 1900 the total wooded surface of the German Empire (omitting Alsace-Lorraine) was 13,556,037 hectares (1 hectare equals 2·47 acres), distributed as follows:—

	Prussia	Empire
	hectares	hectares
Crown forests	72420	257302
State forests	2558469	4307524
Communal forests	1103646	2061684
Forests of public establishments	334401	514715
Private forests	4201197	6414812
Total	8270133	13556037

The species were as follows:—Broad-leaved species of various kinds—among which oak high-forest occupies 5·2 % of the total wooded area—cover 26·7 % of the area; conifers occupy 73·7 % (46·6 % Scots pine, 24·6 % spruce, 2 % silver fir).

I now will show how I consider we may estimate these resources for immediate realisation.

III.

The above-cited statistics also indicate, for all categories of forest and for the chief species, the area occupied by woods of different ages. I extract the following:—

Surface occupied, in thousands of hectares, by the woods of the empire (omitting Alsace-Lorraine)—

Woods of	Oak	Beech	Scots Pine	Spruce	Silver Fir
Years					
61 to 80	64	355	714	349·5	35
81 to 100	52	314	449	219	33
101 and over	92	305	388	161	38

There are thus in the German forests, in round numbers, 3,568,000 hectares of over 60 years, of which about half is Scots pine, over a quarter beech, and a fifth spruce.

If we consider specially the State forests we have the following figures, shown separately for Prussia and for the whole of the empire.

Surface occupied, in thousands of hectares, by the forests of the German States (omitting Alsace-Lorraine) :—

Woods of	Oak		Beech		Scots Pine		Spruce		Silver Fir	
Years	Prus.	Emp.	Prus.	Emp.	Prus.	Emp.	Prus.	Emp.	Prus.	Emp.
61 to 80	78	25	69	141	213	287	48	158	...	8
81 to 100	15	21	73	135	186	235	26	97	...	9·5
101 & over	35	49	87	166	242	282	13	101	...	19

I will note further that there are in Baden and Wurtemberg communal forests containing :—

10,000 hectares of silver fir, aged from 61 to 80 years,
8,000 ,, ,, ,, 81 to 100 years, and
11,000 ,, ,, ,, 101 years and over.

It is somewhat difficult to indicate the volume of available wood occupying the above areas. The statistics give us no information on the point. Confining myself to considering the part of the material utilisable as timber I think I can take the averages given below, which are certainly very moderate :—

Volume per hectare of timber.

Woods of	Oak	Beech	Scots Pine	Spruce and Silver Fir
Years	cub. metres	cub. metres	cub. metres	cub. metres
61 to 80	100	100	100	150
81 to 100	150	150	150	250
101 and over	300	300	250	400

Note.—1 cub. metre equals 35·32 cub. feet.

Applying these figures to those of the area statement we find the following volume of wood available :—

Volume, in thousands of cubic metres, of timber realisable in the whole of the forests of the German Empire—

Woods of	Oak	Beech	Scots Pine	Spruce and Silver Fir
Years				
61 to 80	6380	35500	71400	57690
81 to 100	7800	47100	67300	63120
101 and over	27510	91410	97050	79680

Or, in round numbers, a total of 652 million cub. metres (23,028,640,000 cub. feet) of timber immediately available, of which a little more than one-third is Scots pine, a little less than

one-third spruce and silver fir, and a little less than a quarter beech.

If we now consider specially the State forests we obtain the following figures, given separately for Prussia and for the whole empire :—

Woods of	Oak		Beech		Scots Pine		Spruce and Silver Fir	
Years	Prussia	Empire	Prussia	Empire	Prussia	Empire	Prussia	Empire
61 to 80	1800	2500	6900	14100	21300	28700	7200	24900
81 to 100	2250	3150	10950	20250	27900	35250	6500	26600
101 & over	10500	14700	26100	49800	60500	70500	5200	48000

Or, in round numbers, a total of 338 million cub. metres (11,938,160,000 cub. feet) of timber available in the German State forests, of which 183 is in wood of over 100 years, 85 in wood of from 81 to 100 years, and 70 in wood of from 61 to 80 years. More than a third of this enormous amount of material is Scots pine, which will furnish excellent timber for rebuilding the houses destroyed by the vandal boche. A quarter, in beech, will give good carpentry material. The spruce and silver fir will yield 3 milliards of good planks, which will come in very handy for our needs and to the relief of our own conifer forests. The oak, too, will be very welcome for our cabinet-makers, who are in danger of failing to obtain this first-class material from our own woods, impoverished, ruined and destroyed as they are by the war.

We may ask what is the value in money of these 338 million cub. metres of timber. Although this is a secondary matter, I will attempt briefly to answer the question.

In 1902 the sale price of a cubic metre of wood of all kinds, felled and fashioned in the State forests, was—in Prussia, 15 frs.; in Bavaria, 19·10 frs.; in Baden, 19·75 frs.

The cost per cubic metre of fashioning and transport to the roads was—in Bavaria, 1·60 frs. in 1900, and 1·98 frs. in 1907. We may thus reasonably estimate at 16 frs. the value of a cubic metre of wood standing, and at 5400 million frs. (five milliard four hundred million) the net value of the disposable timber in the German State forests. The value is estimated on the 1902 price; it would certainly be three times as much now.

If we add to what precedes the material from the communal conifer forests of Baden and Wurtemberg we find it comes to 8 million cub. metres, which could furnish 250 million planks,

worth standing, at the pre-war figure, about 200 million frs., and more than three times as much now.

IV.

Is it possible to exploit this mass of wood of which I have just given an idea? Is it morally, that is to say, equitably, possible, and is it materially possible? This it remains to me to examine.

The war has impoverished all our forests; it has ruined many of them, and it has, alas, totally destroyed a too large number in the zone of the operations. The enemy is responsible for all this—for what was used for the waging of the war, and for what was destroyed by him in a spirit of shameful vandalism. It was he who brought about the war in order to assure the domination of the universe by Germany: "*Deutschland, Deutschland über alles, über alles in der Welt.*"

The ruin of houses, the destruction of furniture and implements can be compensated in money; forest produce can only be replaced in kind. We shall not find in the open world-market the wherewithal to replace what we have lost. Our forests will not recover their old capacity of production within a century. We must, therefore, make the enemy pay us in kind, that we may be enabled to properly manage our impoverished forests on the one hand, and on the other that we may reconstruct our appliances and rebuild our houses.

The exploitation of the wooded capital of the public German forests will not be an act of vengeance, but of restitution and reparation. It will be still less an act of spiteful hate, like that which was done by the barbarous boche, the son of Huns and Vandals, when he broke with hammers the sewing-machine of the seamstress, and destroyed the trade of the weaver, when he rendered useless the plough and the thrasher, when he sawed down the fruit trees in the orchards. (*Quod vidimus testamur.*) It will be an act of simple justice. *Spoliatus ante omnia restituendus* says an old precept of law. We may in all conscience accomplish an act of restitution, of reparation and of justice in exploiting the public German forests.

Can it be done materially? How many days' work will be required; over how many years must the work be spread; is the world's market capable of absorbing the 338 million cub. metres which will be thrown upon it?

The actual total production in timber of the German forests is 20 million cub. metres a year. The additional labour, then, required for the exploitation of the whole material of the State forests *in one year* would correspond to 320 million cub. metres.

A pair of experienced woodmen can fell and fashion about $5\frac{1}{2}$ to 6 cub. metres a day in ordinary conditions. If it was clear-felling in old woods, and at all seasons, we may allow an extra 3 cub. metres of outturn a man a day. It results from this that 100 million days' labour would be required to effect the purpose in a year—that is to say, it would be necessary to employ, in addition to the native labour of peace time, a regular army of 330,000 workmen. That seems to me impossible. If we confined ourselves to removing in a year the timber of over 80 years old about 200,000 men would be needed, while for the timber of over 100 years only there would be required 180,000 workmen.

It would be suitable, then, to spread the work over a longer period—say five years. During these five years the native labour would suffice for about 100 million cub. metres. There would remain to be cut by imported workmen about 230 million cub. metres in five years, taking account of the growth of the woods during the period of realisation, or 46 million cub. metres a year. Fifty thousand men would suffice for this task, and that seems to me quite feasible. The labour would be furnished by Bulgarian and Turkish prisoners, who appear to me thoroughly suited to accomplish this work of reparation and justice in the country of their friends, the boches. The Bulgarians especially are very good manual labourers, and would certainly give full satisfaction.

The supervision of this extraordinary felling should be confided to the officers of the army which will occupy the enemy's country till reparation is complete. It would be a pity to turn aside for this work our forest officers, whose numbers, alas, are now so terribly reduced. They have to carry out in France a heavy and difficult task, which will only too fully employ all their strength, competence, and devotion.

There is no doubt that the wood thus thrown on the market would be eagerly welcomed and easily absorbed.

France consumed annually before the war 11 million cub. metres of timber, of which nearly 5 million came from abroad. Our demands are going to be greatly increased, and

our native supplies enormously reduced. I think our country ought to set aside at least 160 million cub. metres for her own use, during the next five years, from the amount of material cut in Germany.

Our British friends used to import annually nearly 15 million cub. metres, which they bought in Russia, Sweden, Norway, Austria, etc., and in their colonies. Their needs are going to be greatly increased by reason of the exhaustion of all supplies. The United Kingdom will certainly be able to absorb about 100 million cub. metres of wood during the five years following the war.

Italy, Belgium, and Serbia would together take about 100 million.

Finally, the Germans themselves—whom we shall be careful to forbid felling timber in competition with us—would absorb a good part of what was not required by our friends and ourselves. We should not, doubtless, refuse to sell to them at a reasonable rate. Germany used annually to buy from abroad 12 to 13 million cub. metres and produced about 20 million.

There is thus no reason to anticipate any difficulty in the utilisation of all this material, provided we take five years at least over it.

V.

Although the object of this article was to consider the forests of Germany, I think I ought to add a few words about the forests belonging, or formerly belonging, to the allies of Germany.

Of the Turkish and Bulgarian forests there is nothing to say. There are no reliable statistics about them. Even if there were, what will remain of these countries themselves after peace comes?

What was formerly Austria-Hungary was a very rich country in forests, both broad-leaved and coniferous. The creation of free republics, our friends, and the re-union of Roumania and Transylvania, will only leave a few provinces to Austria and to Hungary.

Lower Austria contains 681,000 hectares of forest, of which only 4 % belong to the State. In Upper Austria the figures are 408,000 and 14 %; in the province of Salzburg, 232,000 and 53 %; in Styria, 1,049,000 and 5 %; in the Tyrol and Vorarlberg, 1,104,000 and 11 %. Over the whole the conifers (spruce, Austrian and Scots pine, silver fir, larch) occupy at least two-

thirds of the area. The production is estimated at 3 cub. metres per hectare per annum.

Hungary, without Bosnia-Herzegovina, but including Croatia, Slavonia and Transylvania, had 1,114,000 hectares of State forests, of which 302,000 lie in Croatia and Slavonia. These forests are mostly broad-leaved—for four-fifths of the area. Among the conifers the commonest is the spruce.

14. Timber as a Factor in the Price of Coal.

Various exaggerated and erroneous statements have been made from time to time during the last few years regarding the extent to which the price of coal was affected by the increased charges for pit-wood.

It is difficult to give exact figures as to what the percentage increase is, for the reason that circumstances vary so much in every colliery that no uniform rate per ton can be accurate. The quantity of pit-wood used is to a great extent dependent on the thickness of the seam of coal, and even in the same pit where seams of different thickness are being worked, the quantity of pit-wood used per ton of coal produced may vary from year to year.

The article which appeared in the *Transactions* of the Royal Scottish Arboricultural Society for 1917, page 70, gives useful information on the subject. It is there stated that between September 1914 and June 1916 the price of coal delivered rose from 20s. to 30s. per ton, and that 5d. of this increase might be attributable to the rise in the price of pit-wood.

Considerable confusion seems to exist between the price of pit-wood standing in the forest and the price delivered at the colliery. It is obvious that with the greatly increased cost of horse haulage and labour, all the operations connected with the felling, transporting, and manufacture of pit-wood must have at least doubled, and it does not follow, therefore, that greatly increased cost at the colliery necessarily represents a greatly increased price to the landowner for the growing timber.

Another common source of error arises from quoting prices per ton, seeing that the number of cubic feet per ton may vary from 26 to 42, according to the date of felling and the amount of seasoning.

Similar errors are easily made by comparing the price per 100 lineal feet of long pit-wood and short props. The number of lineal feet per cubic foot naturally varies widely in these two cases, and, consequently, the only accurate and fair basis of comparison is one made per cubic foot.

It was stated on behalf of the colliery owners, at a meeting held in Edinburgh on March 1916, that on an average of all collieries, and taking an average seam, seven lineal feet of pit-wood are required per ton of coal raised. If the average size of prop is taken at $3\frac{1}{2}$ inches, each ton of coal raised represents about half a cubic foot of timber in props. The cost per cubic foot of props for all sizes delivered at the collieries has probably been about 2s. during the last two years, as compared with, say, 10d. immediately previous to the war. The increase in the cost per ton of coal raised would, on this basis, be the difference between 5d. and 1s., namely, 7d.

Taking the standing timber, however, the actual amount of increased price which can be said to have been received by the landowner is somewhat less. It is doubtful whether, except in special cases and for small lots, more than 11d. per cubic foot was received for standing pit-wood, and 10d. would probably be a fairer average, as compared with, say, 4d. or 5d. before the war. The increase in either case is 6d. per cubic foot, or 3d. per ton of coal raised.

The statement by the Board of Trade, Timber Supply Department (Scotland), which accompanies this article, shows that the average value per cubic foot of the whole standing pit-wood purchased by the Department in Scotland was equal to 7·78d., and that the prices per cubic foot of the five areas of pure pit-wood included in these purchases ranged from 5·33d. to 1s. 1·67d. (for larch), the average being 9·89d.

It must be remembered also that, while the rate of income tax on all income has been greatly increased during the war, the basis of assessment in the case of woodland has been trebled.

The rise in the price of standing pit-wood has certainly made a product which was almost unsaleable into a saleable article, but it is doubtful whether any instance can be quoted where, after reckoning all costs and compound interest at 5 per cent., any profit has been earned beyond the assessed rent on the woodlands.

Board of Trade, Timber Supply Department (Scotland).

Total amount of standing pit-wood purchased by Department, 5,515,463 cubic feet, valued at £178,796, 14s., is equal to 7·78d. per cubic foot.

Pure Pit-wood Purchases (*included above*).

	Lineal Feet	Cubic Feet	Price Paid
Barwhillanty .	500,840	72,030	£1600 = 5·33d. per c. ft.
Glenlaggan . .	107,000	11,900	385 = 7·76d. ,,
Gullilands (larch) .	212,410	28,322	1600 = 1s. 1·55d. ,,
Keithick . .	57,343	11,184	427 = 9·16d. ,,
Dalswinton (larch)	547,752	68,469	3900 = 1s. 1·67d. ,,

Additional.—Cut pit-wood contracted for from estates and paid for by instalments as delivered :—

	Lineal feet.	
Gairloch . . .	194,017	= £1960
Lovat . . .	10,000,000 at 23s.	= 115,000
Seafield No. 1 . .	5,000,000 at 22s.	= 55,000
,, No. 2 (Inverlaidnan)	10,000,000 at 24s.	= 120,000

Pitwood consigned to Messrs George Horsley & Co., Ltd., at West Hartlepool and Sunderland, from commencement of consignment in July 1917 to 27th February 1919, 13,664,562 lineal feet.

Supplementary Note.

At a recent meeting of the Coal Mines Commission, it was stated on behalf of the miners that a request for increased wages had been met by the coalmasters with the statement that timber and other stores had increased so much in price that the demand could not be conceded.

The following facts relating to the effect of the increase in the price of *timber* on the price of coal may be interesting.

The average importation of foreign pit-wood for the five years 1909–13, inclusive, was 2,944,272 loads, and the average value £3,509,601. The average price during that period was therefore 24s. per load. A load may be taken as approximately one ton. It follows, therefore, that the pre-war price of foreign pit-wood was 24s. per ton. (These figures are taken from the "Report of

the Forestry Committee of the Reconstruction Sub-Committee" published in 1918, C.D. 8881.)

The values per load (or ton) for each of the years 1913–17 of pit-wood imported into Scotland, were as follows:—

Year	Total No. of Loads	Value	Price per Load
1913	475,496	£667,189	28/–
1914	289,979	421,980	30/–
1915	192,449	531,405	56/–
1916	99,272	467,384	94/–
1917	4,763	24,058	102/–

(The figures which are taken from Board of Agriculture returns are given for Scotland, as the prices per load are believed to be higher than those for the United Kingdom.)

The average price per ton for the six months ending 30th June 1918 was 90s. In July 1918 the Pit-wood Control Order, which is still in existence, fixed maximum prices for pit-wood, both home and foreign, which are lower than the highest figure shown above, viz. 102s.

The maximum price paid by the coalmasters may therefore be taken at an average of 102s. per ton. This represents an increase of 325 per cent. over the pre-war price of 24s.

To meet the shortage in supplies the home pit-wood trade was organised and developed during the war, but the maximum prices reached did not at any time exceed (in the aggregate) 102s.

In the Report on "Supplies of Home-Grown Pit-wood," issued in 1914 by the Board of Agriculture, C.D. 7729, it is stated that about 265,000,000 tons of coal are, on the average, raised each year in the United Kingdom, and that the annual consumption of pit-wood may be estimated at 4,500,000 tons, or 1·7 per cent. of the weight of coal.

The increase of 78s. (from 24s. to 102s.) in the price per ton of pit-wood would, therefore, apparently involve an increase of £132, 6s. in the price of 100 tons of coal, or 1s. 4d. per ton of coal. It should be noted that the pre-war price of home pit-wood does not arise. The coalmasters would naturally buy in the most economic markets, and while it is a fact that a limited quantity of home pit-wood was used before the war,

for which very low prices were paid, the great bulk of the consumption was of foreign pit-wood.

It is only fair to the coalmasters to say that the cumulative effect of the increased costs of all stores used in the production of coal may, in their opinion, have discouraged the increase of wages, but timber by itself was not the most influential reason.

15. Re-afforestation and the Supply of Plants.

By Nurseryman.

One of the lessons brought home to us by the Great War has been the need of devoting much more attention to the development of home forestry than we have done in the past. The national conscience has been awakened to the necessity of action, and our commercial nurseries will be called on to meet the large demand for forest-tree plants which is likely to be experienced for a number of years to come. A few notes on the present position as regards the supply of plants available for planting purposes, and the steps being taken by nurserymen to increase the supply, may not be without interest to those who are interested in the forestry question.

As is well known, it was some time after the outbreak of war before the Government showed any signs of being likely to adopt any definite line of action with regard to planting, and nurserymen were entirely left without guidance as to what should be done by them in the unprecedented situation which had to be faced. In the autumn of 1914, most of the nurseries throughout the country were fully stocked, but the demand for their produce practically ceased to exist, and millions of plants had to be burned, thus entailing heavy losses to the owner. At the same time nurserymen had to decide what action was to be taken by them with regard to future sowings, and during the years 1915-18, when there was no signs of an early cessation of hostilities or of a large demand for plants in the near future, it was not an easy matter for them, in the absence of a guarantee from the Government that they would be recompensed for any sacrifices that might be entailed by their keeping up their stocks to a pre-war level, to come to a satisfactory decision as to what course they should adopt.

They were further faced with the difficulty of getting suitable labour for nurseries. No industry gave more generously of its personnel to the army, and even the elderly men and women were frequently unable to remain at their ordinary work, but were tempted away by the larger wages offered in districts where munition factories had been set up.

With the signing of the armistice, it was speedily apparent that there was going to be an unprecedented demand for plants, and it was soon evident that existing stocks would be inadequate for the purpose. Fortunately the situation as regards labour had been somewhat relieved by the prompt action of the Board of Agriculture in initiating steps to secure the release of skilled nurserymen as speedily as possible, and this ensured that this year's sowings would be sufficiently large to affect in time the situation appreciably, but the stock of two-year seedlings and older plants fell far short of the needs of the forester. It must, however, be remembered that this would not have been the case had it so happened that the cessation of hostilities had taken place a few months later than it did. Had the Armistice not been signed until spring, it would have been too late to initiate measures for extensive planting operations this year, and the stocks in the nurserymen's hands would probably have been more than sufficient for the immediate requirements of the industry.

The shortage of plants became acute towards the end of March and April, and would have been felt to an even greater extent had it not been for the long-continued frosts which were experienced from Christmas onwards until April, and which prevented planting operations being undertaken on so large a scale.

The present shortage of plants is not wholly due to labour difficulties and to the nurseryman's unwillingness to run the risk of growing stock which he might not be able to dispose of. The weather and the seasons during the past few years have, from the nurseryman's point of view, been most unfortunate. In 1917 the crop of cones on the Scots pine was not a large one, and in 1918 it was practically a failure. This could not have been foreseen, and unfortunately most of the surplus seed of the two previous years, which in ordinary circumstances would have helped to tide us over the lean years, had been exported to France to help in restocking the woodland areas which had been felled by the British Government for war purposes.

Although nurserymen made every effort to secure whatever cones could be had, and although their efforts in this direction were seconded by the Board of Agriculture, who undertook the organising of the collection on all the areas cut over by the Government, there has probably never been such a shortage of Scots pine seed within the memory of living nurserymen. There has been a fairly large crop of larch cones, but the quality proved very indifferent. The supply has, however, been of importance in helping to eke out the supplies obtainable from the Continent, which have been smaller than usual. In 1918 the crop of both larch and Norway spruce on the Continent fell far short of the expectations of the continental seed firms in allied and neutral countries, and the statements made last autumn regarding the crop had later on to be considerably modified. Continental firms have also been unable to ship as early as usual owing to labour troubles, and owing to a dockers' strike in Denmark large quantities which were being consigned from that country were unfortunately held up at the last minute.

An abnormally wet collecting season in Japan hindered the shipment of *Larix leptolepis*, so that only part of the supplies arranged for arrived in time for this season's sowing. No difficulty was experienced in getting prompt shipment of Douglas fir and Sitka spruce from America, and it is believed that the sowings of these species are much larger than usual.

The weather conditions during last winter and spring were very trying to the nurseryman. In the middle of September an early frost of great severity was experienced, and in some centres the entire stock of larch, both seedlings and transplants, was more or less affected, and to a lesser extent Douglas fir and Sitka spruce; Norway spruce and beech likewise suffered. The stocks of these species must in this way have been considerably diminished, and in addition there were serious losses owing to the dry frosts which were experienced from January onwards. Owing to the absence of snow, the action of the frost was very unfavourable to plants, and frost lifting was much more prevalent than usual. Both thinly grown seedlings in the seed-beds and two-year seedlings lined out suffered very severely, serious losses being incurred. In fact, it was often necessary to lift and transplant whole brakes of two-year seedlings, the roots of which were left with a very precarious hold. There was a decided improvement in the weather during the months of April and

May, and more labour being available, arrears of work were rapidly overtaken, and on the whole transplanting and sowing of tree seeds were finished only a few days later than in normal years.

Although nurserymen have not been able to accomplish so much as they intended, still the area of seed-beds will be much larger this season than in any year since 1914. The only disturbing element in extending the area of seed-beds is the difficulty experienced in finding women or boy labour to undertake the work of weeding.

In some quarters it has been feared that the home nurseries are incapable of raising all the forest plants that will be required, but is there any reason why they should not be able to do so? It is simply a question of labour and a normal supply of seeds, and granting a shortage meantime, it is not so acute as some people imagine. There is good reason for assuming that by the time the necessary surveys and plans have been arranged, ample home supplies to meet all requirements will be ready; but it is a reasonable proposition that nurserymen should be told, not a month or two but a year or two, in advance what the country's requirements are going to be. Surely the cultivation of forest plants is an industry which deserves encouragement quite as much as agriculture. No other form of husbandry requires so much labour, and it is the most intensive form of cultivation possible in this country.

16. Memorandum as to Taxation of Woodlands in Scotland, with special reference to Liability for Income Tax, etc.

The burdens at present falling to be borne by a proprietor of heritable estate (including woodland and timber thereon) are as follows:—

1. *Income Tax* (*Sch. A*).—On the net annual value of the land occupied by the timber (*i.e.* the gross annual value p. Valuation Roll less allowances in respect of Rates and Maintenance) in respect of the ownership thereof;
2. *Income Tax* (*Sch. B*).—On the gross annual value of the land in respect of the occupancy thereof; or alternatively,

Income Tax (*Sch. D*).—On the average profit on the basis of three years in respect of woodlands managed on a commercial basis.

3. *Super Tax.*—On the basis of Income Tax (Sch. A and Sch. B or D).

4. *Land Tax.*
5. *Ministers' Stipend.*
6. *Heritor's Assessment.*

These burdens are imposed in respect of the ownership of the estate as a whole, including the annual value of the woodland areas thereon.

7. *County Assessments.*—On the gross annual value of the land—both as proprietor and occupier.
8. *Parish Rates.*—On the gross annual value, subject to a varying deduction allowed by the Rating Authority—both as proprietor and occupier.

9. *Estate Duty.*
10. *Succession Duty.*

On the capital value of the land and the timber thereon as at the date of the succession.

Note.—Assuming the succession to have taken place after 30th April 1909, the payment of the duty applicable to the capital value of the timber ("after deducting all necessary outgoings since the death of the deceased") is postponed until the realisation thereof, the rate of the duty payable being determined by the value of the remainder of the estate without aggregation.

From the foregoing statement of burdens it will be observed :—

1. That woodlands are in the same position with regard to taxation and Death Duties as other classes of heritable property, subject to the postponement of the payment of Estate Duty and Succession Duty until the realisation of the crop in the case of the timber; and
2. That in the case of Income Tax (Sch. B) and local burdens no allowance is made in respect of the very considerable period which must elapse before the realisation of the crop of timber as compared with an ordinary agricultural crop.

For the purposes of this Memorandum it is only proposed to deal with the incidence of

Income Tax and Super Tax

in view of the necessity of obtaining the modification or re-adjustment thereof in respect of the special circumstances

affecting woodlands, as it is found in practice that proprietors do not feel justified, in consequence of the present onerous burdens on this class of property, in proceeding with planting schemes.

The creation in the near future of a Forest Authority for the United Kingdom, and the urgent national necessity for the replanting of felled areas and the afforestation of additional land, present a favourable opportunity for arriving at a proper method of assessment for Imperial taxation in the case of woodlands managed on a commercial basis, and with this in view the following suggestions are submitted :—

1. That in respect there is no other class of property, so far as known, which is treated both as capital and also as income for the purpose of taxation, the present practice of levying Death Duties on the capital value of the timber should cease, and that Imperial taxation should be limited to Income Tax on the net profits derived.
2. That in respect woodlands are not suited in any way for letting, either on yearly tenancy or even on lease, and are invariably and necessarily in the occupation of the owner, the profits obtained from the ownership and occupation thereof are one and indivisible and should be assessed under a single schedule.
3. That in respect on most estates old woods predominate in area a special allowance should be made, prior to assessment, on account of the accumulated amount of Income Tax paid in the past under both Schedules A and B.
4. That in respect the present method of assessment under Schedule B is based upon too limited a period, the net profits should be ascertained over an extended period and the system of calculating the same substantially modified and put upon an equitable basis.

With the view of effecting the above the following scheme, which is necessarily in rough outline and without elaboration of details, is submitted :—

1. Any owner of woodlands to have the right to elect to be charged to Income Tax under Schedule D in place of Schedule B.
2. Any owner electing to be assessed under Schedule D, as aforesaid, to furnish the National Forest Authority with a schedule showing the total acreage of the woodlands

owned by him and the description of these woodlands in age-classes of say ten years up to fifty years and twenty years above fifty years.

Note.—A distinction would probably have to be made between conifers and hardwoods.

3. Income Tax (Schedules A and B) already paid in respect of the woodlands included in the above schedule to be determined according to a scale to be framed jointly by the Inland Revenue and the Forest Authority as applicable to all cases and allowed as a deduction prior to assessment to Schedule D.
4. The amount of the above deduction to be arrived at on a percentage basis according to the ages and extents of the woodlands detailed in the schedule, and decrease at the rate of 2 per cent. per annum as from the date of the first assessment.

Note.—It is assumed that in fifty years the whole of the timber which had previously paid Income Tax under Schedules A and B would have been realised.

5. Income Tax (Sch. D) to be levied on the basis of five years' average or preferably seven years' average.

It is unnecessary to deal specially with Super Tax, as the same follows the Income Tax assessment.

The following is a simple illustration of the working out of the above scheme :—

1 Age of Woods	2 Extent	3 Percentage of Total Area (excluding Unstocked Ground)	4 Percentage Deduction for Income Tax—say
	Acres		
Unstocked . .	15	...	...
1–10 years . .	100	16·7 per cent.	7
11–20 ,, . .	70	11·7 ,,	22
21–30 ,, . .	30	5·0 ,,	37
31–40 ,, . .	...	...	...
41–50 ,, . .	50	8·3 ,,	67
51–70 ,, . .	150	25·0 ,,	80
71 years and over	200	33·3 ,,	100
	615	100·0 per cent.	

64·5 per cent.

Note.—The percentages in Column 4 are merely estimated, but have been inserted in order to illustrate the principle.

In the above illustration the abatements in the Schedule D assessment would be as follows:—

1st year . 64·5 per cent.

2nd year . 63·2 per cent., *i.e.* 64·5 per cent. – $\frac{1}{50}$th,

and so on thereafter, the amount of the abatement being reduced by $\frac{1}{50}$th each year until exhausted.

The above claim would involve a certain amount of initial trouble both to the Inland Revenue and the owner of the woodlands, but the particulars required are only such as would be available on any well-managed estate with proper records, and once ascertained no further trouble is involved except the slight annual readjustment in the percentage deduction.

It may be considered necessary to provide for a revision of the schedules in the event of sales taking place, but it would be preferable that the percentage deduction when determined should be adhered to for the period of exhaustion in the case of estates where the woodlands are situated in different counties, but it would be desirable that the scheme should be applied to the total area of the woodlands irrespective of the situation thereof.

In the event of an owner not furnishing the necessary information he would be assessed to Income Tax (Sch. B) in ordinary course, and would have no more grievance than if he had neglected to make a claim for repayment of Income Tax in respect of "Rates" or "Maintenance."

17. The Forests of New Zealand.

By D. E. Hutchins.

The forests of New Zealand are of great value. They are admittedly the best softwood forests in the Southern Hemisphere, and nine-tenths of the world timber used is softwood. The Government Offices building at Wellington, reputed the largest wooden building in the world, is constructed of New Zealand timber.

The New Zealand forests have never been surveyed, and only vague estimates have been made of their area and stand of timber. The working of the sawmills, however, shows that the outturn of sawn timber over the area milled has averaged about 1500 superficial feet per acre (a superficial foot = 12″ × 12″ × 1″).

If one compares this figure with the average stand of timber throughout the forests of the United States of America, it will be seen that the New Zealand figure is two-and-a-half times the average timber-stand of the original virgin forest of America, and over three times that of the present American forests. Exceptionally, and over small areas, timber-stands in New Zealand up to 200,000 superficial feet per acre have been recorded.

In quality, New Zealand timbers come before those of Europe and Australia, and after those of North America. The value of kauri timber is well known, but it is not generally known that kauri is the record largest timber-producing tree in the world. There are trees that are taller and somewhat thicker, but the bole of kauri bulks the largest on account of its having little or no taper. The massive columnar shape of the tree has struck all observers from Charles Darwin onwards. There was at one time about three million acres of kauri forest in New Zealand; very little is now left, but there are about half a million acres of restorable kauri forest. It is calculated that this, if restored, would pay all the cost of the great war to the next generation or their children.

As a good illustration of the value of kauri forest, it has been shown that the best of the old-time forests, if it had been preserved, would have been now worth over £9 per acre. It was not a large forest (17,300 acres); in fact, only the area of Wellington Harbour up to Somes Island.

Totara, the next most valuable New Zealand timber, is the best of all the world's *Podocarpus* timbers. This genus contains many very valuable timbers, in New Zealand, in South Africa, and elsewhere. The most valuable forests now left in New Zealand are of totara. The timber is like a hard cedar, very durable, of fine colour, but brittle.

Rimu is the common house-building timber of New Zealand, found everywhere throughout the Dominion, from north to south. It is a beautiful timber compared to the ordinary house-building timbers of Europe and America. The finest-figured timber, seen in panelling, surpasses oak in colour if not in grain.

White pine is a lofty, clean-growing tree with white, odourless timber, unsurpassed for butter boxes. Its growing scarcity is forcing attention to the forest question in New Zealand.

Honeysuckle (*Knightia excelsa*) is a very common timber of quite unique marking and figure, but in the absence of a Forestry Department or the forestry of other countries, it was simpler to burn it and work only the timber with established markets. Thus it has never been exported, and is quite unknown on the European market.

There is a large class of so-called secondary timbers in New Zealand forests which have never been utilised. Yellow pine (a species of *Dacridium* allied to rimu) is intrinsically the most valuable timber in the country. It has been carefully worked in the south, but in the north used only for firewood because there it came into competition with other timber more profitable to work! In a new country, without the capital and scientific knowledge of older countries, there must inevitably be some loss in developing national resources. But when an active and enterprising people, good at farming, good at mining, and at all the average Englishman knew sixty years ago, but without a suspicion that such a science as forestry existed—when such a people takes charge of the finest forest in the Southern Hemisphere, the loss in developing it may easily run into quite incalculable millions. The forest has been destroyed without demarcation or any attempt to discriminate between land best suited for farming and land best suited for forestry. Present prices, that is pre-war prices for timber, show that a normal kauri forest, taking ordinary timber-yield figures, will return about £10 net per acre per year.

In 1886, the forest area of New Zealand was estimated, by T. Kirk, at twenty-one million acres. By 1909 it was estimated that this area had become reduced to about seventeen million acres. This estimate was founded on a special inquiry and saw-mill census instituted by the Lands Department, *Forestry in New Zealand*, by W. Kensington, 1909. This official report, and that for 1907, embody nearly all that has been published regarding the forests and timber of New Zealand. The papers are well illustrated by photos and maps, and repay careful perusal.

The New Zealand forests, even in their present reduced and neglected condition, are worth more than all the known mineral wealth of New Zealand, and they still offer more employment than any other industry. Compared to sheep-farming, the New Zealand forest, if worked as are forests in Europe, would afford about ten times the employment, and the timber market for

softwoods in the Southern Hemisphere is larger than the New Zealand forests could ever fill.

In spite of their value, the New Zealand forests have had a sad history. The early pioneers came from a country where State forestry was unknown, but where there was enough wealth to pay huge sums yearly for imported timber—£43,000,000 the year before the outbreak of war. The early colonists knew nothing of the forestry of any other country than England, and they were thrown entirely on their own resources. They had to destroy the forests to live!

With the dawn of the present prosperous days the indiscriminate forest destruction continued. The Government of the country continued in the main on British models. The forest administration and the scientific forestry of other civilised countries were still left in abeyance, and the public conscience salved by the making of comparatively insignificant plantations of doubtful exotics. Whether considered by area or in timber production, the Government timber plantations represent about $\frac{1}{500}$th of the forest requirements of the Dominion.

The plantations were started in 1896, and are now over 30,000 acres in extent. They have cost (at an average all-round rate) £13 per acre, or £65, reckoning interest at 4 per cent. up to 40 years, which it is hoped may be their average maturity age. This is an all-round figure, which has to be modified by additions and subtractions. The present working rate is about £10 per acre. Taking the all-round figure, about £2,000,000 sterling has been sunk in the Government timber plantations of New Zealand, and since these have been made without the usual skilled direction, there have been serious mistakes and losses. But the local officers have put in excellent work, and the plantations afford most interesting studies in experimental tree-planting, the trees planted being mostly those which have given good results in the British Isles. The largest group of plantations, about two-thirds of the whole, are near the popular watering place, Rotorua, the remainder being at Hammer, towards the north of South Island, and at Tapanui, farther to the south. At all of these places there is good hotel accommodation for visitors, and easy access by rail and motor service.

The beautiful native forest is still to be seen sufficiently near roads and railways throughout the Dominion. It is within half an hour of the capital by boat, or rail, or tram. The best forest

in which to see the majestic kauri trees is the Waipoa forest, Nokianga. This forest of 30,000 acres has recently been demarcated—a first stage in real forestry, and will be opened up by a railway and numerous roads after the war. There will also be accommodation for visitors at the "Forest Stations," which are placed in carefully selected and commanding positions for the sake of outlook against fire. These localities afford superb views over the forest, and a freedom from the sand-flies and mosquitoes which are troublous at certain seasons in the forest. The three best kauri forests are Waipoa, Wara-wara, and Puketi, near the west coasts of the far north, lat. 35°, and total some 75,000 acres altogether.

The beautiful beech forests of the south, so much like the European beech forests, and so pregnant with possibilities of economic improvement, are best seen from Queenstown and the head of Lake Wakatipu. South of this, the Milford Sound walk is full of forest interest, but the walk which easily surpasses all others for the forester is that down the west coast beyond Ross. It was here I measured the tallest tree yet recorded in New Zealand—a white pine of 210 feet in height.

18. A Bark Beetle, *Cryphalus abietis*, Ratz.

Under the heading of "The Structure, Bionomics and Forest Importance of *Cryphalus abietis*, Ratz.," by Walter Ritchie, B.Sc., Carnegie Research Scholar in Entomology, University of Edinburgh, there appeared, in vol. v., Nos. 3 and 4, of the *Annals of Applied Biology*, a paper of considerable importance to the forester.

In it Mr Ritchie sets forth the results of his researches into the structure, life-history and habits of the bark beetle, *Cryphalus abietis*, Ratz. Material for the work was obtained in Aberdeenshire, Kincardineshire and Midlothian.

Of the six species of *Cryphalus* recorded in Fowler's *Coleoptera of the British Isles*, two, namely *C. abietis*, Ratz., and *C. piceæ*, Ratz., are bark beetles attacking conifers, while the others are found on broad-leaved trees. The two species found on conifers were formerly considered rare, but records of *C. abietis* have been obtained for many districts in Scotland, so

that it would appear to be now by no means an uncommon insect.

The generic characters are given as follows from Fowler: (1) eyes entire or slightly emarginate; (2) antennæ with the sutures of the club distinctly marked, the club itself being somewhat variable in shape; (3) thorax tuberculate in front, margined at base; (4) scutellum small punctiform; (5) elytra not excavate at apex, clothed with a scale-like pubescence and sometimes, in addition, with fine raised hairs.

Fowler's description of the species is given as follows:—

C. abietis, Ratz. Oblong, subcylindrical, compressed and very convex: fuscous or fuscous-brown, dull, antennæ and legs reddish-brown, club of the former usually darker, rounded at apex: thorax subglobular, very finely punctured at sides and behind, front part confusedly granulate: elytra rather more than double as long as thorax with distinct punctured interstices, covered throughout with extremely short scale-like hairs, and also very diffusely with short erect hairs which are wanting behind: the colour of the antennæ and the legs is somewhat variable: the species may easily be recognised by the tubercles on the anterior portion of the thorax being few in number and irregular in their distribution, and by the regular comparatively strong rows of punctures and very short pubesence of the elytra. Length 1 to $2\frac{3}{4}$ mm.

The investigator's own examinations of the species lead him to emphasise the following points:—

(1) Club of antennæ rounded at apex, antennal funicle four-jointed.

(2) Tubercles on prothorax irregular in distribution (not in concentric circles) and wide apart.

(3) Elytra covered with very short scale-like hairs, their interstices with a diffuse row of short erect hairs, which are absent on the apical parts.

From the measurement of a large number of specimens of various origin, he finds the average length to be 1·75 mm.

Detailed descriptions, with numerous illustrations, are given of the egg, and the structure of the larva and imago. These are of considerable importance, especially to the student working on Scolytidæ.

The forester in his daily work pays great heed to the galleries of bark beetles, and in many cases is guided by their appearance

detecting and naming an offending insect. In the case of *C. abietis* this is made difficult by the frequency with which the galleries are rendered confused and irregular through overcrowding.

Foresters are generally acquainted with the under bark workings of several bark beetles, particularly with the pine beetle, *Myelophilus piniperda*, in which one strong mother gallery is formed. The galleries of *C. abietis* are different. These circle round the base of a branch or twig, which, according to its size, may or may not be completely girdled by one gallery. The species is monogamous, and the female does most of the work in cutting the gallery, which generally varies in breadth inversely to its length. This working occurs only on the inner bark layers, and the size is said to average $\frac{3}{4}$ inch in length by $\frac{1}{8}$ to $\frac{3}{16}$ inch in breadth. The male gives some assistance in widening the gallery, although his chief help seems to be in clearing out the fine bore dust. The gallery is completed in five to seven weeks. Egg-laying proceeds in a different manner from that of the pine beetle, where small notches are made for the reception of the eggs. *Cryphalus abietis* makes no notches, and the eggs usually occur in batches. The newly-hatched larvæ burrow along the sides of the mother gallery for some time, but they ultimately separate, each one forming its own tunnel. These early gnawings of the larvæ often change the appearance of the mother gallery to such a degree as to render it unrecognisable.

The larval galleries are cut almost at right angles to the mother gallery. On the main branch they are sometimes vertically up and down, at other times they run obliquely; often they run along the girdled branch or twig. When nearing pupation the larva usually cuts into the outer surface of the sapwood, but, prior to this, whether it cuts into the sapwood or not depends on the thickness of the bark. The investigator found, for instance, that the galleries cut immediately before pupating and the pupal pit were, as a rule, the only traces on the sapwood, but "where the bark was somewhat thick, as in the case of strong branches, the larval galleries did not groove the sapwood at all, and usually on these branches pupation took place in the bark." Thin-barked branches and twigs, when infested, show the larval galleries grooved in the sapwood and a marked pupal chamber. After they emerge, the young

beetles feed for a time on the inner bark around their pupal beds and then issue forth by small exit holes.

This description refers to typical unconfused galleries, but it is impossible in most cases to trace either mother or larval galleries when the outer bark is removed. It is usual to find all the inner layers of bark converted to dust.

It would appear that many factors influence the period of the life-cycle from egg to adult. This time varies according to the season of the year, the quality of the food material, and the degree of shade or sunshine to which it is exposed. In one case, from eggs laid in May the larval state extended over June, July, and into August; pupation was during parts of August and September, and perfect beetles emerged during the latter month. These lived over winter, and practically the same cycle was produced in the next year. Under the same conditions, however, eggs laid in June might produce larvæ which live as such till the following June. The perfect beetles then emerge in July. In the typical life-cycle it would appear that the larval period is from 69 to 71 days, but when the larval stage is carried over the winter it may extend to 11½ months or longer.

Investigations into the number of broods that may be expected in a year are rendered difficult by the fact that, after the first egg-laying the parents do not always die, but may feed for a period and again proceed to pairing and egg-laying. Making deductions from repeated observations, the investigator has come to the conclusion that "even under the most favourable circumstances the occurrence of a double generation in the succession of parents, children, and grand-children within a single year is most unlikely." Similarly, microscopic examination of the reproductive organs of females that had completed egg-laying in June, and had remained feeding under the bark till November of the same year, showed that these were not yet ready for egg-laying.

Cryphalus abietis has been found on the Continent mainly as a spruce-attacking species, although it is also known to be an enemy of *Abies* and *Pinus*. Of the genus *Pinus* it is said to prefer *Pinus strobus*. In Scotland it is recorded on various species of *Abies*, as well as *Picea excelsa* and *Pseudotsuga Douglasii*.

The favourite breeding-place is in dead and sickly trees, twigs and branches of all ages. It is said to prefer material not exposed to the sun. Heaps of brushwood are common places

for egg-laying, but in these cases it is usual to find the upper branches passed over unless the heap is in shade.

Attacks by the beetle may be detected by examining the axils of dead twigs or branches where the workings of the insect may be shown by the presence of fine bore dust.

This investigation adds to the repeatedly emphasised need of burning the litter of brushwood now lying scattered over the country. It is quite conceivable that *Cryphalus abietis* might become an additional serious insect pest, especially dangerous to young and newly-formed plantations. M.

19. The Measurement of Timber.

(*With Plate.*)

By JOHN CAPE, Statistician, Board of Trade, Timber Supply Department, Scotland.

Since the publication of the report of the Sub-Committee of the Reconstruction Committee appointed by the Government, all interested in forestry are now looking forward to energetic action on the part of the State in the immediate future. In all probability the present year will see the opening of the era of scientific forestry in our country. In the above report one of the duties assigned to the Commission, which the Sub-Committee recommend should be set up, is the "Collection and Preparation of Statistics relating to Forestry." In view of this, the time is surely ripe for the considering of a more satisfactory method of timber measurement than that of the present "Quarter-Girth System."

Probably about two centuries have elapsed since Hoppus first issued his book on timber measurements, based on the quarter-girth measurement. Since then the system has become universally used by foresters and timber merchants in our country. The quarter-girth measurement is easily obtained, and by referring to the Hoppus tables the contents can be readily found. This has probably been the main reason for the continued use of the system, which has the great disadvantage of being inaccurate. A closer examination of the method adopted will reveal the inaccuracy referred to:—

$$\text{Formula} = V = \frac{\left(\frac{g}{4}\right)^2}{144}$$

V = Volume g = the girth or circumference.

One-fourth of the girth of the log is measured in inches, then squared and multiplied by the length of the log in feet and divided by 144 to obtain the volume in cubic feet.

In order to test this formula, take as an example a perfectly cylindrical log, 10 feet long by 48 inches in circumference. The mathematical formula for obtaining the volume or contents of a cylinder is equal to the area of one end multiplied by the perpendicular height to the other end, or :—

$$V = AH$$

where V = Volume ; A = area of base ; H = height.

The area of the base of a cylinder being a perfect circle is calculated from the formula $\pi r^2 = 3{\cdot}1416 \times (\text{radius})^2$

$$\text{or } {\cdot}7854\ D^2 = {\cdot}7854 \times (\text{diameter})^2.$$

The circumference = $D\pi$ = diameter × 3·1416.

In the example given, therefore,

If the circumference = 48

then the quarter-girth or $\frac{g}{4} = 12$

$$\text{Diameter or } \frac{g}{\pi} = \frac{48}{3{\cdot}1416} = 15{\cdot}272$$

and radius = 7·636

Sectional area = πr^2 = 3·1416 × 7·636 × 7·636

= 183·180 square inches

= 1·272 square feet.

The contents or volume of the cylinder, therefore, will be—

$$V = AH$$
$$V = \pi r^2 \times H$$
$$= 1{\cdot}272 \times 10$$
$$= 12{\cdot}72 \text{ cubic feet.}$$

Measuring the same cylinder by the quarter-girth system we get—

$$V = \left(\frac{g}{4}\right)^2 \times \frac{H}{144}$$
$$= \frac{48}{4} \times \frac{48}{4} \times \frac{10}{144}$$
$$= 10 \text{ cubic feet}$$

showing a loss of 2·72 cubic feet, equal to 21·38 per cent.

It does seem strange that this method of measuring round timber, which shows such a large percentage of error, should

have remained in universal use so long. Some writers explain this inaccuracy as an allowance to the buyer, to compensate him for the loss and waste incurred in squaring the stick. Schlich, in his *Manual of Forestry*, says:—"In comparing this with the real sectional area—$\cdot 0796 \times g^2$—it is found that the quarter-girth method gives only $78\frac{1}{2}$ per cent. of the true basal area and volume, omitting $21\frac{1}{2}$ per cent. The method is based upon the assumption that this amount represents the waste incurred in squaring the timber." If this assumption were correct our sawmillers should be producing in square-edged sawn timber the same number of cubic feet as the original log contained, according to the quarter-girth measurement. In general practice this does not hold good. For instance, the writer has noted that in numerous cases, with logs of larch, the percentage of bark exceeded 21 per cent. This would, therefore, on quarter-girth measurement over bark, leave the sawmiller practically no margin whatever for loss in slabbing or saw-draught.

The inaccuracy of the quarter-girth system was also disclosed when the Government placed an import duty on foreign timber. A considerable loss to the revenue would have resulted from the adoption of the old system, and accordingly the Custom House authorities drew up various rules of measurement, which remained in force until 1866, when the duties on foreign timber were abolished. The method of measuring the round timber remained the same, but the divisor was reduced so as to bring out the contents of the log as near to the accurate as possible. The square of the quarter-girth, instead of being divided by 144 to obtain cubic feet, was divided by 113. In some cases the square of the diameter was taken, the divisor then being 183. *The Standard Timber Measurer*, compiled by E. A. P. Burt, gives tables from which the contents of round timber, calculated on these two rules, can be readily got, the result being for all practical purposes accurate.

Again the well-known prevailing custom of taking a load of round timber as equal to 40 cubic feet, whereas a load of sawn timber is taken as 50 cubic feet, condemns the quarter-girth system. The weight of the two loads, granted the timber is of equal dryness, is approximately the same, for the simple reason that the true contents of the two loads are similar. The one, however, is measured by quarter-girth measurement, while the

other is accurately measured. For instance, a log of 40 feet long and 12 inches quarter-girth, gives according to quarter-girth contents 40 cubic feet, whereas by true measurement the log actually contains 50·88 cubic feet. If, in future, the measurement of round timber was based on true measurement, the load in every case could be taken as 50 cubic feet.

It will be seen, therefore, that while up to the present the quarter-girth system of measuring round timber has been considered sufficiently satisfactory for transactions between buyer and seller, it has been, in fact, a compromise measure—the seller losing the difference between the actual contents and quarter-girth contents, and the buyer the difference between the latter and the actual cubic feet of sawn timber manufactured therefrom. From no point of view can this system be considered entirely satisfactory.

Indeed, no system can be so, unless it is founded on the mathematical formula for obtaining the volume of the geometrical figure most nearly approaching the form of a tree or log. For this purpose the following formulæ are involved:—

Mathematical Formulæ for finding the Volume of certain Solids.

1. Cylinder (Fig. 1) $V = AH$ = area of base × height
2. Cone (Fig. 2) $V = A\frac{H}{3}$ = area of base × $\frac{1}{3}$ height
3. Truncated cone (Fig. 2) $V = (A_b + A_t + \sqrt{A_b + A_t})\frac{H}{3}$
4. Paraboloid (Fig. 3) $V = \frac{AH}{2}$
5. Truncated Paraboloid (Fig. 3) $V = (A_b + A_t)\frac{H}{2}$
6. Neiloid (Fig. 4) $V = \frac{AH}{4}$
7. Truncated Neiloid (Fig. 4) $V = A_b + 4A_m + A_t)\frac{H}{6}$

Mathematical Formulæ for finding the area of a Circle and Ellipse.

1. Circle. Area $= \pi r^2$ or $\pi\left(\frac{D}{4}\right)^2$
2. Ellipse. Area = Dd × ·7854.

D = Long Axis. d = Short Axis.

FIG. 1

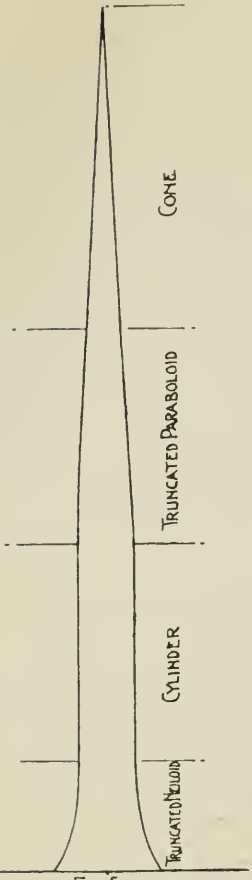


FIG. 5

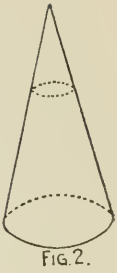


FIG. 2.

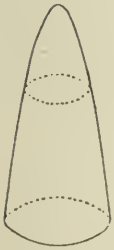


FIG. 3.

FIG. 4.

COMPARISON OF TREE FORM WITH THAT OF CERTAIN SOLIDS.

[*To face p.* 130.

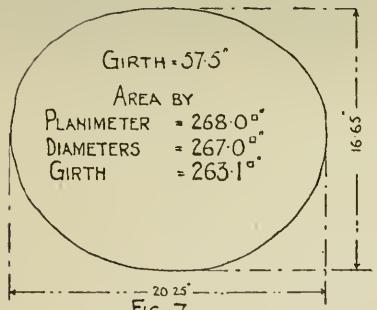


FIG. 7.

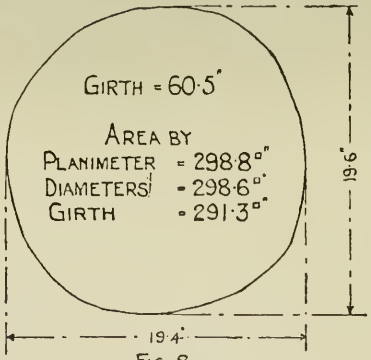


FIG 8.

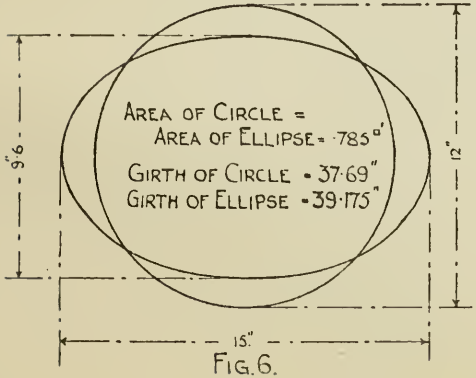


FIG. 6.

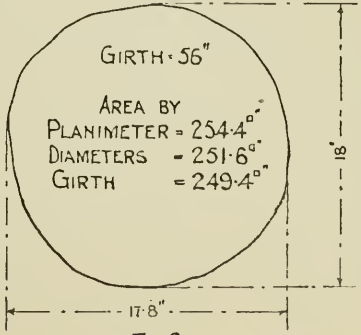


FIG. 9.

AREA CALCULATIONS OF SECTIONS.

Mathematical Formulæ for finding the Perimeter of a Circle or Ellipse.

1. Circle $= D\pi$

2. Ellipse $= d + 2(D - d) - \frac{d\,(D - d)}{(D - d)\,(D + 2d)}$

If trees grew uniformly and retained the same shape or form throughout their lifetime no difficulty would be experienced in taking measurements for calculating their volume. As a matter of fact not only do trees not grow uniformly, but different portions of the same stem differ in form.

Most trees show a very rapid taper for several feet above the root, and this portion resembles most nearly the form of a truncated neiloid (Fig. 5). A portion of the stem above this may show practically no taper, and will, therefore, partake of the form of a cylinder, while the taper from that point may become gradual, and then more rapid, giving the third section the form of a truncated paraboloid. The top portion of the stem usually resembles in shape that of a cone. Thus by measuring a tree in sections, which correspond in form to the contour or outline of one or other of these geometrical solids, a very accurate calculation can be made of the volume of timber in the tree.

This method, however, is not practical for ordinary work, as it involves the taking of too many measurements. In the great majority of cases, it will be found that the stem of a true resembles most closely that of a truncated paraboloid. It should be noted, however, that no matter what formula or combination of formulæ are adopted for ascertaining the volume of a tree or log, the length and sectional area at one or more points are essential. The measurement of the length is an easy matter, but that of the sectional area is not so. The horizontal cross-section of all the geometrical solids, described above, is represented by a circle, but unfortunately an exceedingly small percentage of trees will give a cross-section of a true circle. Only in the case of a true circle can the area be calculated either from the measurement of the circumference or girth, or of the diameter. With a given perimeter the circle encloses a greater area than any other figure, and this being so, whenever the section of a log or tree deviates in form from that of a true circle an erroneous result will be obtained by calculating the area from the measurement of the circumference or girth. For

example, a circle (Fig. 6) with diameter 12 inches, has an area of ·785 square feet, and an ellipse, with axes 15 ins. × 9·6 ins., encloses the same area, but the circumference of the circle is 37·69 inches, whereas that of the ellipse is 39·175 inches. Moreover the greater the difference between the long and short axes the greater will the error be in calculating the area from a girth measurement. Diagrams Nos. 7, 8 and 9 show various sections, with the areas calculated from girth and diameter measurements.

In each case the area was first found by making use of the "Planimeter," after which the areas were calculated from the average of two diameters taken at right angles to each other, and from the girth measurement.

From the results given, it will be seen that whenever the section deviates from the form of a true circle the most accurate result is obtained by calculating from diameter or calliper measurements. Schlich refers to this point in his *Manual of Forestry* as follows:—"Generally, the sections of trees approach the shape of an ellipse, the greater axis of which lies in the same locality, as a rule in a constant direction. Where trees are much exposed to wind, the greater axis lies generally in the direction of the prevailing wind; in Western Europe, therefore, from west to east, or from south-west to north-east. The inaccuracy caused by measuring the girth and calculating therefrom the sectional area, has been found to amount on an average to about 7 per cent. Where only one diameter is measured, the error may be the same or even more; where two diameters at right angles are measured, and the mean taken, the error generally does not exceed 2 per cent. of the true amount."

Before considering what system of measurement should be adopted in future in our country, the following rules should be examined:—

Various Methods of Cubing Logs.

1. The Hoppus quarter-girth method has already been described. It is generally used in Britain, but gives very inaccurate results, being 21·5 per cent. in error.

$$\text{Formula} = V = \frac{\left(\frac{g}{4}\right)^2 \times L}{144}$$

2. The Custom House quarter-girth rule has also been referred to. The formula in this case is :—

$$V = \frac{\left(\frac{g}{4}\right)^2 \times L}{113}$$

Practically the true contents of a cylindrical log can be obtained from this rule. The method of arriving at the result, however, is unsatisfactory. It is obviously simply a method of correcting the result obtained by Hoppus without altering the erroneous system of measuring. Neither of these two systems gives a true sectional area, and both, for that reason alone, are useless for scientific work.

3. Fifth girth is a very old rule, which is said to be still used in France, and was at one time in use in Britain. The formula for this rule is :—

$$V = \frac{2\left(\frac{g}{5}\right)^2 \times L}{144}$$

Twice the fifth of the girth in inches squared, multiplied by the length in feet, and divided by 144 to obtain cubic feet. The rule is very much more accurate than the quarter-girth rule, and gives a sectional area approximately correct as the following example shows :—

Take a circle 40 inches in circumference. The area by fifth girth rule—

$$= 2\left(\frac{40}{5}\right)^2 = 2(8)^2 = 128 \text{ sq. inches}$$

or ·888 sq. feet

the actual area being ·883 sq. feet.

This rule, however, has the fault common to all rules necessitating the girth measurement, *i.e.* that it can only be applied if the section of the log is a perfect circle.

4. *Newton's rule.*—For this rule the following measurements are required, viz. length, sectional area at butt, middle and tip of log.

$$V = (A_b + 4A_m + A_t)\frac{L}{6}$$

This formula holds good for obtaining the volume of a truncated cone, paraboloid or neiloid, and is extremely accurate. It, however, necessitates a considerable amount of measuring,

which for ordinary work should be avoided; but it is to be recommended in the case of long logs of valuable timber.

(5) *Hossfeldt's rule.*—This rule involves the taking of the length of the log, and calculating the sectional area at the tip and at one-third the length from the butt. The formula is as follows:—

$$V = \left(\frac{3A_{\frac{1}{3}} + A_t}{4}\right) L$$

and is applicable to a truncated cone or paraboloid. The results obtained are accurate, especially when applied to butt logs.

6. *Huber's rule.*—This is the rule in general practice in Europe. It is very simple, and for ordinary work sufficiently accurate. It involves the taking of fewer measurements than any other rule. The formula in this case is:—

$$V = A_m \times L$$

The sectional area at half the length is taken and multiplied by the total length. The formula is that for the finding of the volume of the frustum of a paraboloid. The results are quite satisfactory, and the rule is very easily applied in field work.

7. *Smalian's rule.*—This rule involves the taking of the butt and tip diameters and the length. The sectional areas for the butt and tip are calculated and averaged. The formula of this rule is as follows:—

$$V = \left(\frac{A_b + A_t}{2}\right) L$$

With regard to the latter two rules, Carter in his *Mensuration of Timber*, a book issued by the office of the Inspector-General of Forests, Calcutta, says:—"Both formulæ contain an error, the extent of which is proportionate to the amount of difference between the diameters at the top and base respectively of the log, that is to say, to its degree of taper, and this error increases as the square of that difference. Huber's formula always gives too small and Smalian's too great a result, the error of defect in the one case being one-half of the error of excess in the other." If, however, the diameters at butt and tip are averaged before calculating the area, the result will be exactly the same as that obtained from Huber's rule.

Where a pile of logs is to be dealt with, a great deal of labour, and consequently expense, is incurred in the taking down of the

pile, and measuring each individual log. In many such cases it is easy to get the tip and butt measurement, and therefore by adopting this system a sufficiently satisfactory result would be obtained.

In order to compare the results obtained from these various rules, take a log 36 feet in length, perfectly circular in section and with an even taper from butt to tip. Let the diameter at the butt be 18 inches and at the tip 6 inches, then the diameter at the middle will be 12 inches, and that at a third length from butt 14 inches. The cubic contents of the log according to the various rules described will be as follows:—

	Sectional Area, Sq. Ft.	Cubic Contents.
1. Hoppus Quarter-Girth Rule: $V = \frac{\left(\frac{g}{4}\right)^2}{144} \times L = \frac{9{\cdot}42 \times 9{\cdot}42}{144} \times 36 = {\cdot}616 \times 36 = 22{\cdot}176$		
2. Custom-house Quarter-Girth Rule: $V = \frac{\left(\frac{g}{4}\right)^2}{113} \times L = \frac{9{\cdot}42 \times 9{\cdot}42}{113} \times 36 = {\cdot}785 \times 36 = 28{\cdot}260$		
3. Fifth Girth Rule: $V = \frac{2\left(\frac{g}{5}\right)^2}{144} \times L = \frac{2 \times 7{\cdot}538 \times 7{\cdot}538}{144} \times 36 = {\cdot}789 \times 36 = 28{\cdot}404$		
4. Newton's Rule: $V = \frac{(A_b + 4A_m + A_t)}{6} \times \frac{L}{144} = \frac{735{\cdot}131}{6 \times 144} \times 36 = {\cdot}851 \times 36 = 30{\cdot}636$		
5. Hossfeldt's Rule: $V = \frac{(3A_{\frac{1}{3}} + A_t)}{4} \times \frac{L}{144} = \frac{490{\cdot}088}{4 \times 144} \times 36 = {\cdot}851 \times 36 = 30{\cdot}636$		
6. Huber's Rule: $V = \frac{A_m}{144} \times L = \frac{113{\cdot}097}{144} \times 36 = {\cdot}785 \times 36 = 28{\cdot}260$		
7. Smalian's Rule: $V = \frac{(A_b + A_t)}{2} \times \frac{L}{144} = \frac{282{\cdot}743}{2 \times 144} \times 36 = {\cdot}981 \times 36 = 35{\cdot}316$		

It will be seen from the above that the results vary according to the number of cross-sections taken. The greater the number

of sections averaged the more accurate the result will be. If, for instance, we take a sectional area at every 3 feet, *i.e.* at every inch of diameter from butt to tip of the above log, and take the average of all these sections and multiply by the length, the result will be as follows :—

Volume calculated from average of Thirteen sections.

	Sect. Ar., Sq. Ft.	Cub. Conts., Cub. Ft.
$\frac{A_b + A_3 + A_6 + A_9 + \ldots\ldots A_t}{13} \times \frac{L}{144} = \frac{1613{\cdot}206}{13 \times 144}$	$= {\cdot}861 \times 36$	30·996

Thus the rules of Newton and Hossfeldt are undoubtedly the most accurate. Huber's rule gives a less and Smalian's a greater result, but it should be noted that this difference depends entirely on the degree of taper on the log. If the log has no taper, the results will be the same in every case. On the other hand, the greater the degree of taper, the greater will be the discrepancy between these rules.

For the ordinary measurement of round timber, however, Huber's rule will be found the most convenient, and provided that two diameters are taken at right angles to each other, and averaged before the sectional area is calculated, a sufficiently accurate result will be obtained for all practical purposes.

In the writer's opinion, this rule, which is in general use in Europe, should be adopted in our country. It would be a distinct step in advance on the old system, and should prove most satisfactory for forestry work, both scientific and practical, in the future.

When calculating the volume of standing timber by means of basal area, *i.e.* the area of the cross-section of the stem taken at breast-height multiplied by the height and form-factor, it is quite absurd to proceed by using the quarter-girth rule, as the result of the following surveyed plot shows. The species dealt with was Scots pine, with a mean height of 49 feet and 93 years of age. The area of the plot surveyed was ·184 acres. As the girth measurement only was used when the plot was surveyed, the only comparison which can be made is between the results as calculated from quarter-girth and full girth. The quarter-girth system shows a volume per acre of 4110 cubic feet, and a basal area per acre of 206 square feet, whereas by calculating from full girth measurements, the volume per acre amounts to

5212 cubic feet and the basal area to 262 square feet. The difference, as will be seen, is very considerable, and had the plot taken been measured according to the above rule recommended by the writer, a still more accurate result would have been obtained.

System in America and Canada.

There are a great number of log rules in force in America and Canada, most of them being based on practical experience. They all, however, set out to give the contents of manufactured timber which the log will produce, and not the actual cubic contents contained in the log. This system is a distinct advantage to a buyer, as it gives him an idea as to the amount of the lumber he will have to place on the market, and he can fix his offer when purchasing accordingly. If in future the forests of this country were measured on the rule recommended by the writer, it would be of undoubted advantage to timber merchants and others purchasing timber to have a fairly reliable rule by which to calculate the amount of manufactured material they might reckon on getting from the timber purchased. The loss, owing to conversion, varies so tremendously on account of the varying classes of timber to be sawn, and the many different kinds of material to be manufactured, that it is impossible to devise a rule which will hold good in all cases. The writer has carefully considered this question, and has arrived at the following rule, as one which should give to those engaged in the conversion of timber a reasonably safe estimate of what they can expect to produce in ordinary scantlings from a log measured according to the rule recommended in this paper.

The formula for this rule is:

$$\tfrac{1}{2}(D^2)L.$$

The amount of manufactured material produced from a log is taken as equal to a square log, having as its section an area equal to the square inscribed in the mean sectional area of the log.

The rule is not put forward as an accurate one under all conditions, but as a valuable guide to timber merchants and others in arriving at the amount they are prepared to offer for a plantation, the volume of which is calculated on true contents, and not on the old erroneous quarter-girth system.

In conclusion, at such a time as the present, when the need

for afforestation is so great, and when the Government of the country has in contemplation schemes for the establishment of forestry as a national industry, no reasonable objection can be offered to the adoption of a more accurate rule of measurement than that in use. The writer feels, however, that in order to facilitate the universal adoption of such a rule, and thereby ensure its success, a complete and accurate set of tables would have to be compiled, from which the contents of timber can be at least as readily obtained as from the present Hoppus table. Personal experience has also impressed upon the writer the paramount importance of such a set of tables, and, in order that the difficulty might be bridged, he is at present engaged on the compilation of tables giving the true contents and yield of sawn timber contents from the rules he has advocated. These he intends to publish in the near future, in the hope that they may be of value to all connected with forestry and the timber trade generally, and prove one step forward in the placing of forestry on a truly scientific basis.

20. Forest Tree Seed.

By Alexander S. MacLarty.

The main object of this paper is to point out the great importance of growing all forest trees, whether indigenous or exotic, from properly selected seed, and to emphasise the urgent necessity of selecting in a more careful and scientific manner the seeds from which future crops of timber are to be raised. The choosing of suitable trees and localities from which seed is to be obtained is very important work indeed, and this work is termed in this paper Seed Selection. British silviculturists do not pay enough attention to these matters. I do not, however, wish in any way to disparage the useful work done, often under difficult and discouraging conditions, by not a few enthusiastic silviculturists, scientists, and nurserymen. Agriculturists and horticulturists take great pains to ensure that none but the best seeds are used for the raising of their crops. Not only must the seed have good qualities in so far as cleanness, weight, and germinative power are concerned, but its inheritable qualities, which are unalterable, must also be satisfactory. The result is that many kinds of farm and garden

crops have been greatly improved. Stockbreeders have vastly improved their stocks of cattle, horses, and sheep by carefully and scientifically breeding from the best strains and specimens. I see no reason why forest trees cannot also be improved by greater care, and by a fuller application of scientific methods in the selection of the seed, both at home and abroad. It is well known that there are many well-equipped seed-testing stations abroad, which no doubt put on the markets beautifully cleaned seed, which may be termed very good if judged by its weight standard and percentage of germination. But the fitness or suitability of seed cannot be correctly estimated by its cleanness, weight, or germinative power. In every case the origin of the seed must also be taken into consideration. The selection and collection of tree seed is too often left to inadequately-trained persons. This should not be tolerated. Other important forestry operations, such as seed sowing and planting, are, if carried out on anything like a large scale, always under the direct charge of men trained to the work. The very important work of seed selection should also be carried out under the supervision of thoroughly experienced and trained men, who should be able to deal with the matter in a judicious and scientific manner. Now in connection with the selection of tree seed, there are naturally many points which should have careful consideration. The following are perhaps the most important points:—

1. Type or strain of tree from which the seed is collected.
2. Locality or region in which the parent tree is growing.
3. The health of the parent tree.
4. Age of parent tree.

Point 1 is very important, chiefly because of the far-reaching influence of heredity in plant life as well as in animal life. There may be in existence several types or strains of any species of tree, just as there may be in existence several types or strains of any breed of animals. Some types and strains in animals and trees may, of course, be good and profitable, while other animal and tree types and strains may be undesirable and unprofitable. It will be the seed selectors' business to see that the seed is obtained from none but the best types and strains. In primeval forests which were regenerated naturally, some species were represented by several types, which, as a rule, were

associated with certain regions. But now, owing to man's interference, some types may be found a long way outside of the regions with which they have been in the past respectively associated. The securing of a suitable type or strain for a particular locality is a very important matter indeed. After several years of careful observation, I have come to the conclusion that a wood on this estate contains two distinct types of Scots pine (*Pinus silvestris*). The trees in this wood are nine years of age. They were purchased from a nurseryman. I do not know where the seed from which the trees were raised had been collected. It would be interesting and instructive to know where it came from. For the sake of clearness and distinction, let us name the types A and B respectively. Trees belonging to type A have good stems, from which the branches stand out almost horizontally. Most of the branches, however, curve slightly upwards at the tips. An average stem is 7·5 feet high, and has an average girth of 4·5 inches. The dark brown bud scales lie close to the buds. In outline the trees of type A are more cylindrical than those of type B, the average stem of which has a height of 6·5 feet and an average girth of 3·75 inches. The stems are clad with branches which have an ascending tendency. They grow out from the stems at an angle of about 60 degrees. The bud scales are ruddy brown, and have a decided outward curve at the tips. These buds thus lack the smoothness of the buds of type A trees. In these brief remarks I have merely touched on differences which, so far as I can judge at present, are indisputable. I may, perhaps, state that at a considerable distance I can now easily distinguish the one type from the other. Trees belonging to type A evidently produce a larger volume of timber than trees belonging to type B, at anyrate when growing in a mild district such as this. Type B, although more branchy, is altogether more slender in build than type A. All the trees in the wood have received equal treatment and attention. They are, without a doubt, the production of seed taken from two different types of trees. It is quite obvious that the indiscriminate collection of seed, without any regard to type or strain, is a mistake which may lead to failure and financial loss, while, on the other hand, scientific and careful seed selection tends to improve timber crops, and thereby leads to good financial results. In the forest, the vigorous, quick-growing tree will kill or suppress the

less vigorous and slower-growing specimen, provided man has not interfered with nature. It naturally follows that, eventually, the majority of the trees in the forest which will bear seed will be those which have proved themselves to be the most vigorous and quick-growing. We want vigorous and quick-growing timber of good quality. But if man, by whatever means, gives numerical preponderance to the worst specimens, he interferes with the laws of nature, and encourages the survival of the unfit, which conduces to deterioration and, perhaps, ultimately to extinction. Although sporting occurs, like tends to reproduce like. Therefore, if we persist in collecting seed from bad specimens, unsuitable and bad types and strains, we cannot look for much improvement of the species although the harvesting of the seed and the treatment and environment in nursery and forest are all that can be desired. The seed selector should always remember that each tree has an individuality of its own, and that its qualities, good or bad, can be transmitted to its offspring through the medium of the seed. Let us suppose that a forester plants a number of larch trees all equal in size and age, and that during their lifetime they receive an equal chance to grow and develop, there may yet be a considerable difference in their size and condition of health when they reach maturity. Again, let us suppose that some person visits the mature trees for the purpose of collecting seed. Would it be a wise or a practical plan to collect the cones right away, without ever giving a moment's thought as to which would be the best trees from which to take the cones? I do not think it would be a wise or a practical plan. Seed selectors should never neglect to take into consideration the individual characteristics of the specimens from which the seed is to be collected. Cones or seed should never be taken from trees of small size, abnormal branch development, or with crooked and ill-shaped stems. Large, straight, well-balanced specimens in good health should be chosen. Dwarfish trees, or trees having an abnormal branch development, often produce a large amount of seed, which is easily obtained owing to the small size or branchy nature of the trees. Trees such as these are very attractive to any seed collectors who are paid according to the quantity of seed which they collect. Woods in seed-collecting areas which have, through mismanagement or any other cause, undergone from an early age a gradual process of thinning out of the best

specimens, will ultimately contain only second- or third-class trees, and seed collected from such trees cannot be called the best. Larch woods in Scotland have, in some instances, received somewhat harsh treatment in this respect. If seed from inferior trees is being constantly used, it is quite possible that a strain will be brought into existence which, in volume and perhaps quality of timber produced, and in vitality, shows unmistakable signs of deterioration.

We now come to point 2. The hardiness, rate of growth, period of growth, and general suitability of trees for any particular district, as well as the quality of the mature timber, may be greatly affected by the place of growth of the parent trees which produce the seed, or perhaps I should say, the climate of the place of growth. The characteristic weather of any locality or region depends on its distance from the sea, latitude, elevation, geographical conformation, soil, vegetation, etc. Now the most important climatic elements are temperature, moisture, in its various forms—such as rainfall, cloudiness, humidity—and wind, all of which influence the constitutional characteristics and habits of trees. There is no doubt that the raising of timber crops would be more successfully and profitably accomplished if this matter were thoroughly understood, and always followed out on scientific lines. Much could be done by our Government. It could provide the money necessary for research and for the collection of reliable data. Also it could approach the Governments of seed-producing countries, with a view to co-operating with them in the matter of seed selection, investigation, and research. Probably the danger of damage by late spring frosts could to a considerable extent be avoided by a more scientific selection of the seed. Some species of exotic conifers, although quite suitable for our soils, are very liable to be damaged by frost late in the spring time. They do not seem to have patience enough to wait till all danger of frost is past. Can this be remedied? I do not think it is impossible. It is well known that there is often a considerable disparity in the time of flowering and sprouting of trees belonging to the same variety or species. Trees growing in cold climates or situations may be later in flowering or sprouting than trees of the same kind or variety growing in warmer climates or situations. When the seed of a species which is very liable to be frosted is

being selected, late flowering and sprouting specimens in late situations or climates should be chosen, everything else being equal. Through time we might thus produce a late flowering and sprouting strain, thus avoiding, to some extent at least, the danger of damage by frost. Several exotic species have a bad habit of making secondary growths in autumn, especially if the weather is mild. These secondary growths, being soft and unripe, are often damaged or completely destroyed by the winter's frost. This defect might also be partially or wholly removed, if the influence of place of origin was thoroughly investigated, and taken into consideration when selecting seed. A strain of trees might be produced which would not be so easily tempted to rush into growth by mild autumn weather, such as we often have in Britain, particularly on the west coast. The difficulties encountered in seaside planting are well known. High winds, salt spray, and salt-laden air make the establishment and rearing of seaside woods difficult and costly. Many species of conifers and hardwoods have been tried with various results. Some species have, of course, proved much more suitable than others. Suitable species could be improved, and brought to a higher degree of suitability if the seed were always obtained from a good class of parent trees, well inured to the conditions under which their offspring will be expected to exist. I rather doubt whether the seed from which our seaside trees are raised is always collected in maritime regions. Although some parcels of really well-selected seed suitable for seaside planting may arrive from abroad, yet owing to the lack of organisation, and the "happy-go-lucky" methods which prevail, the plants produced may never be planted at the seaside. Although many exotic species grow well and retain their vigour in Britain when raised from foreign seed, still their offspring may, owing to the influence of new environments, not be just as vigorous, and may be somewhat more subject to disease. On the other hand, some species may show an all-round improvement. It is important, therefore, that the behaviour of trees raised from the seed of home-grown exotic species should be kept under careful observation, and compared with trees grown from well-selected foreign seed.

Regarding point 3, I do not think any sensible person will for a moment have any doubts as to the importance of obtaining seed from healthy trees, with robust constitutions. Seed

selectors should have a thorough knowledge of tree diseases, and be acquainted with the situation and extent of every infected area. The collection of seed from diseased specimens should not be allowed. Yet many thousands, perhaps millions, of larch trees(*Larix Europæa*) have in the past been raised from seed collected from diseased specimens. We need not, therefore, be at all surprised if the constitution of the larch shows signs of weakness and lack of disease-resisting powers. Really nothing else could be expected. The continued use of seed collected year after year from large numbers of diseased trees has, in all probability, undermined the constitution of the larch. Vast numbers of trees which fell easy victims to disease (*Dasyscypha calycina*) were allowed to reproduce their kind, until a strain of trees has been brought into being which is peculiarly susceptible to the inroads of disease. If seed from perfectly healthy trees had always been used, it would have gone a very long way towards preserving the constitutional robustness of the larch. As many tree diseases—such as fungus diseases—are infectious, and may be easily carried along with the seed, every precaution should be taken, so as to prevent the use of seed collected in areas or forests in which infectious diseases abound. In fact the collection of seed in such areas or woods should be prohibited: "Prevention is better than cure."

With regard to point 4, I think a mature tree in the prime of life will, as a rule, produce more vigorous seed than an immature tree or one which, through old age, is verging on collapse. The using of large quantities of seed taken from very old or very young trees should, as a rule, be avoided, notwithstanding the fact that some trees may produce good seed as soon as, or immediately after, they reach the seed-bearing stage. Until trees attain maturity it is difficult to judge their qualities of endurance, adaptability, and timber production. A mature parent tree may be considered as having "stood the test," while a young parent tree has not, and may be the first tree in the wood to succumb to any severe test of endurance, such as a long spell of drought or an exceptionally severe winter. So there must be a safety in selecting mature parent trees. It is a well-known fact that early or abundant seed-bearing sometimes indicates constitutional disturbance or failing health. A very old tree has certainly "stood the test," but old age has

lowered its vitality, and although it throws most of its energy into the production of seed, yet its offspring have a less chance of being strong and vigorous than have the offspring of a tree in the prime of life. In Britain at present there are considerable numbers of comparatively young exotic trees bearing seed. If mature specimens of any species are scarce or non-existent, patience should, I think, be exercised until seed from trees approaching the prime of life can be obtained. At anyrate, judgment on the merits or demerits of home-grown seed, as compared with foreign seed collected from mature trees, should be reserved till seed from mature home-grown trees can be obtained. I feel I cannot conclude these brief remarks regarding point 4 without mentioning that I have just read in the press that "an interim Forest Authority, which has been created a short time ago, under the chairmanship of Mr Francis D. Acland, is busy investigating the best sorts of seeds with which to make good the heavy war fellings." It is to be hoped that investigation will be followed out on scientific lines, and although size, weight, and germinative power must each receive their due attention, and although the standard of cleanness must not be lowered, the origin of the seed should in every case be most particularly enquired into. Every effort should be made to prevent the indiscriminate dumping down in Britain of foreign seed the origin of which is unknown, or which has been collected in a region which experience and science have shown produces unsuitable seed in so far as the British Islands are concerned.

Although nursery work does not come within the scope of this paper, yet a few words on seedlings may not be out of place, as there is a close relationship between the seed and the seedling. None but the best class of seedlings should be purchased for lining out, and when seedlings from home nurseries are being lined out, none but good quality plants should be used. The undersized and the weaklings are, as a rule, unsatisfactory and unprofitable, and are not worth a place in nursery lines, even in cases where germination and uniform development have been difficult. Small or weakly plants may have within them inherited qualities which will render them unsatisfactory, no matter how well they may be tended or how much money may be spent in rearing them. It is a decidedly bad policy to use undersized or weakly seedlings. The follow-

ing is a case in point. A number of years ago I saw in Aberdeenshire a Scots pine wood which had been raised from cheap seedlings of poor quality. The wood was then about seventeen years of age, and the contrast between it and a neighbouring Scots pine wood of the same age, which had been raised from good strong seedlings, was very great. Most of the trees in the wood raised from inferior seedlings were low, crooked, and very branchy, while most of the trees in the wood raised from good seedlings were tall, straight, and well balanced. It is quite possible that some of the desirable and undesirable qualities of the trees in these woods were inherited. Seed selectors would do well to shun on all occasions woods of the same class as the wood raised from inferior seedlings. Cross fertilisation should, I think, receive more attention from seed selectors and everybody interested in timber growing. Even among coniferous varieties, in which botanists tell us cross fertilisation is rare, there is ample scope for investigation. In recent years so many new varieties have been introduced to British woods that the opportunities for crossing will be greater than ever in future years. Cross fertilisation between *Abies Nordmanniana* and *Abies pectinata* has been recorded. Now if these species were not growing in the same locality, cross fertilisation in the natural way at anyrate would be impossible. On one occasion I heard it said that "no one ever succeeded in growing good trees from bad plants," but I do not hesitate to say that no one ever succeeded in rearing the best class of plants or trees from bad seed.

21. Forestry in the Past, Present and Future.[1] A Review.

This little book consists of an introduction and fourteen propagandist articles on forestry in the past, during the war period, and in the future. The historical portion (Parts I. and II.) is, we presume, intended to place the reader in possession of facts which will enable him to understand the problems that the future presents, and there is, indeed, room for a book which will render accessible to the public the history of the woodlands

[1] *Commercial Forestry in Britain: its Decline and Revival.* By E. P. Stebbing. pp. vi + 186.

of the British Isles. We fear, however, that in this work the reader will find neither an adequate nor a reliable guide.

The first three chapters deal with the history of forestry in three periods: the first to 1482; the second from 1482 to 1885; and the third from 1885 to 1914. Although for the adoption of the first period there is the precedent of Dr Nisbet, it is quite an arbitrary division, and derives, we suggest, from a confusion of an English statute of very limited scope with a definite economic change. However, we are not disposed to quarrel with any division which may be convenient for purposes of exposition, and we have much more serious fault to find with Mr Stebbing's account of this period, which consists of an inaccurate description of *English* forests and forest law. There is no mention of Scotland, Ireland, and Wales, which have a different history from England, and which were not subject to English law. From the head of a Department of Forestry in a Scottish university, we might reasonably expect some reference to Scottish forest law and to the denudation of the forests of Scotland in the Middle Ages, which so impressed visitors to the country: did not one say:

"And for ther trees, had Christ beene betrayed in this countrey, as doubtles he should have beene had he come as a straunger amongest them, Judas had sooner founde the grace of Repentaunce then a tree to hang him selfe on"?[1]

The Scottish Government had indeed endeavoured to replenish the woodlands, and under James II. an act was passed with the object of requiring tenants to plant woods and trees. This act anticipated by a quarter of a century the legislation in England which is taken by Mr Stebbing as marking the beginning of an era, and it would be valuable to have an authentic account of the reasons for the disappearance of Scottish forests which took place, certainly in the Lowlands, at a far more rapid rate than in England. The omission of reference to Ireland might, perhaps, be defended on the ground that in his first chapter Mr Stebbing purports to deal only with Great Britain: but the history of forests in Ireland is bound up

[1] In a tract ascribed to Sir Anthony Welldon, and said to have been written on the occasion of James VI.'s visit to Scotland in 1617. The reader who is unacquainted with the document may find it in Hume Brown's *Early Travellers in Scotland*, pp. 96 *seq.*, or in Hist. MSS. Commission: Report on MSS. of Lord Middleton, pp. 184 *seq.*

with that of forests in England, and Mr Stebbing, in later chapters of his book, endeavours to cover the British Isles.

It would take up too much space to discuss all the points in Mr Stebbing's historical account of British forests to which exception might be taken, and we must confine ourselves to a few matters which we have specially noted. He states that the "Romans assisted to some extent in decreasing the forest area by driving their great roads through the country and in clearing areas for their encampments, and to prevent ambuscades." He appears to be unaware that in the later Roman period Britain was a corn-exporting country, that metals were worked and cloth manufactured. Without consideration of these factors, clearly a very erroneous impression must be formed, and we are not in point of fact without some guidance as to the areas of the country that had been cleared for other than military purposes.[1]

When we come to the mediæval period we are rather surprised at the assurance with which it is stated that "from early times after the departure of the Romans the forests in England were utilised by the King and his nobles for purposes of sport and the chase. . . . Large tracts of country were reserved as Royal hunting-grounds, these areas consisting of blocks of country which included agricultural land, waste lands, as well as forest. Within the Royal hunting-grounds only the King and his nobles were allowed to hunt. . . ." If we are not mistaken this account is based upon the spurious *Constitutiones Forestæ* of Canute: but the fragmentary and uncertain evidence for the dim six centuries from the fifth to the eleventh would not, we suggest, lead to the conclusions so confidently adopted by Mr Stebbing.

Let us pass on to the Conquest. "William I.," we read, "took over the Royal hunting-domains of his Saxon predecessors. Within a brief interval he became alarmed at the rate the forest lands were being disforested, and to prevent this he extended the boundaries of the hunting-grounds of the Saxon Kings and called them Royal forests, all such lands being termed 'afforested' lands. . . ." What Mr Stebbing really supposes to have been the action of the Conqueror we are at a loss to discover, nor can we attach any meaning to the second sentence of the quotation.

[1] Cf. Haverfield, *The Romanisation of Roman Britain* (1915), pp. 26, 27.

Leaving on one side for the moment an account of English forest law, based apparently upon Nelson's edition of Manwood, an unsafe guide to the mediæval period, we find the statement that "Edward I. carried on this policy of disafforesting large areas of the Royal forests and lightening the burdens of the Forest law." The truth is that Edward, having given way to political pressure, obtained dispensation from the Pope and revoked and annulled the grants and disafforestments which he had been forced to make. The struggle continued in the reign of his two successors, with the final result that large areas were eventually removed from forest jurisdiction. It is, however, a strange misreading of history to suggest that mediæval sovereigns willingly renounced their privileges, and Edward I. above all, who "derived great pleasure from hawking and hunting, and had a special joy in chasing down stags on a fleet horse and slaying them with a sword instead of a hunting spear," and who, as Professor Tout says, "never willingly surrendered the most insignificant of his prerogatives."[1]

Mr Stebbing proceeds to trace the effect of mediæval forest law, and tells us that "one curious result of the high-handed action of the Norman kings . . . is that by the end of the eighteenth century the only areas of the old forests of the country left were the remnants of the Royal forests of Dean, Windsor, the New Forest, Epping, etc. For assuredly, but for the fact that these remained Royal forests—*i.e.* were not 'disafforested'—they would have disappeared with the rest . . ."

To-day more than 95 per cent. of the area of woodland in England and Wales is privately owned, and a not very much greater area of Royal forest was under timber at the beginning of the nineteenth century than now.[2] The great bulk of the wooded area at that date was privately owned, and although, doubtless, at some time in large measure subject to forest law—the precise extent of mediæval Royal forests is still a matter of conjecture—it had long ceased to be troubled by any special jurisdiction. To suggest that the survival of an attenuated jurisdiction in very limited districts had any effect upon the conservation of woodlands, whether in the possession of the Crown or of private persons, points to a surprising ignorance of the management of Crown forests in the past. Some indication of the system

[1] *Political History of England*, iii., pp. 136, 138.
[2] Cd. 7488, pp. 11, 19, *seq.*

pursued will be found in the "Joint Annual Report of the Forestry Branches" for 1912-13,[1] and fuller details will be found in the Reports of the Commissioners appointed under the Act of 1786 (26 Geo. III. c. 87). The history of the Forest of Dean may be taken as example. The Crown was empowered in 1668 to enclose and plant up 11,000 acres: this was apparently done, but by 1705 the fences had apparently been allowed to lapse. In 1736 the local officer in charge reported that the forest had been entirely neglected during the preceding thirty years, and that only a few of the 11,000 acres remained enclosed. In 1788 the Commissioners appointed under the Act of two years previously reported that since the beginning of the century all care appeared to have ceased; the actual area remaining enclosed was only 675 acres. About the beginning of the nineteenth century Lord Nelson remarked, "The state of the forest at this moment is deplorable . . . the generality of trees for these last fifty years have been allowed to stand too long; they are passed by instead of removed, and thus occupy a space which ought to have been replanted with young trees . . . where good timber is felled nothing is planted, and nothing can grow self-sown, for the deer (of which only a few remain) bark all the young trees. Vast droves of hogs are allowed to go into the woods in the autumn, and if any fortunate acorn escapes their search, and takes root, then flocks of sheep are allowed to go into the forest, and they bite off the tender shoot. . . . There is also another cause of the failure of timber: a set of people called Forest Free Miners, who consider themselves as having a right to dig for coal in any part they please; these people, in many places, enclose pieces of ground, which are daily increasing by the inattention, to call it by no worse name, of the surveyors, verderers, etc., who have charge of the forest."

The minutiæ of English forest laws are not a matter of great importance to those who are dealing with the forest policy of to-day, but it is to be regretted that Mr Stebbing should not be accurate. He states that "by . . . the 'Assize of Woodstock' the old forest laws were modified and made independent of the common law of the country." This is apparently borrowed from

[1] Cd. 7488, chapters iii. and iv. See also *English Forests and Forest Trees*, 1853: a popular account, but reprinting some valuable documents, in particular a report by Lord Nelson on the Forest of Dean, which is a scathing condemnation of official incompetence.

Dr Nisbet,[1] who presumably misunderstood a passage in Stubbs.[2] The "Assize of Woodstock" in no way modified the status of the forest law, whatever modifications it may have introduced into details. It is the contemporary *Dialogus de Scaccario* which contrasts the forest laws, which are the outcome of the king's will and pleasure, with the common law.[3] But the Dialogue is a descriptive treatise, not an enactment. A misconception of the nature of warren leads to the statement that it was "an inexpensive gift for the king to give to a camp follower or underling," and this supposititious practice is held up for our admiration and imitation in "settling soldiers on small holdings as a reward for good service during the war." We may contrast this curious perversion of law and history with Mr G. J. Turner's opinion that "by the middle of the fourteenth century it is probable that the majority of *lords of manors* enjoyed this right in virtue of grants to them or their ancestors."[4]

Minor matters we may note are the fantastic etymology of "purlieu," which Mr Stebbing takes over from Manwood,[5] and the translation, "No Man from henceforth shall lose neither Life nor Members for Killing our Deer," which was hardly worth borrowing from Manwood's editor, Nelson, when the actual text of the Charter of the Forest of 1217 is easily accessible.[6]

In the modern history of forestry and timber there is perhaps not so much difficulty in avoiding misstatement of facts, but we find reason to dissent from Mr Stebbing's view of the economic position of timber in this country. We may indicate the general trend of his argument by brief quotations.

"The watchful care of the Parliaments of this period, and their enactments to ensure the proper management and protection of the British woods, were solely due to a recognition that the upkeep of the country's fleets was dependent on the maintenance of a sufficient area of British woods managed on the lines most suitable for the production of the national requirements."

[1] *Elements of British Forestry*, p. 20. *Our Forests and Woodlands* (1909), p. 18.

[2] *Constitutional History* (1874), i. pp. 402,403.

[3] Lib. i., cap. xi. Cf. Pollock and Maitland, *History of English Law* (1898), i. p. 177.

[4] *Select Pleas of the Forest* (Selden Society), p. cxxiii. The italics are ours.

[5] Purlieu is the same word as *purale*, and has nothing to do with "pure" (see *O.E.D.*, s.v.).

[6] Art 10. Nullus de cetero amittat uitam uel membra pro uenacione nostra.

". . . early in the nineteenth century, having obtained the command of the seas, timber imports began to make their presence felt on the home markets up to then supplied from home woods."

"The old methods of building ships were changed by the use of steel, etc., the building trade were employing cheaper materials, which replaced the fine old English timbers by the long, straight, clean-grown firs and pines of the North European forests."

The problem cannot be understood unless the misconceptions involved in these passages are removed. It must be emphasised (*a*) that England (with which country again Mr Stebbing is almost entirely concerned), and in large measure Scotland, were, until comparatively recently, wholly dependent upon outside sources for coniferous timber, and (*b*) that until the utilisation of coal for smelting and general industrial and domestic purposes, the woods were being gradually denuded to supply fuel.[1] In the mediæval period, agriculture gradually encroached upon woodlands, but this factor had little influence in the modern period. The difficulties in the way of supplying ships' timber, although a matter of great concern from the early seventeenth century, were largely due to the gross mismanagement of the Crown forests, and the general problem would have been much the same whether supplies for shipbuilding had been easily procurable or not.

It is probable that the importation of coniferous timber had already begun in the twelfth century.[2] In 1623 the Eastland Company stated that abundance of deal boards had been imported in English bottoms,[3] and Raleigh considered that this was one of the important branches of the carrying trade which might be taken out of Dutch hands.[4] In 1721 nearly four

[1] Cf. Cd. 7481, pp. 7, 8. Cunningham, *Growth of English Industry*, ii. pp. 60, 65, 316 *seq.*, 523.

[2] *Pipe Roll* 32 *Henry II.*, pp. xxi, 116, 199.

[3] Cunningham, *Growth of English Industry*, ii. p. 235. As to Scottish timber trade in sixteenth century, see *Acts of Parl. of Scot.*, ii. pp. 373, 499, 544; iii. p. 82.

[4] "The exceeding groves of wood are in the east kingdomes, but the huge piles of 'wainscot, clapboard, firdeale, masts and timber is in the Low-Countreyes, where none groweth, wherewith they serve themselves, and other parts, and this Kingdome with those commodities; they have five or six hundred great long ships continually using that trade, and we none in that course." *Observations touching Trade and Commerce with the Hollander* (1653), p. 26.

million separate pieces ("deals, pine timber, pine boards, and planks"), as well as 23,000 loads of coniferous timber, were imported into England alone: the importation into Great Britain in 1771 was much larger, and had nearly doubled again in 1790.[1] Clearly, the foreign timber trade was of importance at a much earlier date than Mr Stebbing supposes.

Side by side with the modern development of the import trade went the planting of coniferous timber in Britain: in this connection Mr Stebbing mentions the Atholl estates, and we are grateful for this reference to Scotland, but space might have been spared for a fuller description of planting operations both in Scotland and England. In particular, reference might have been made to the early efforts of the Earl of Haddington at Tyninghame.

We have dealt at some length with the historical part of Mr Stebbing's book, because we wish to emphasise the need for sound teaching and writing on a subject which had much better be left alone than treated perfunctorily and carelessly. It is necessary for any writer to ascertain the facts himself, and not to draw his information from authorities already second-hand. Especially do we hope to be spared, in any future book on forestry, from the curiosities of English forest law, which for the most part have nothing to do with the question of economic forestry at all.

In discussing modern policy, Mr Stebbing is on different ground. His opinion of the activities of the Development Commissioners who "took up the question [of forestry] in a spirit of enthusiasm and approached it from the proper view-point" is not likely to be shared by many readers of this journal, although he states that "it is beyond dispute." We do not think he appreciates the relations of the Commissioners and other public departments in the formulation of schemes and the administrative difficulties which have arisen therefrom, nor does he meet the criticism which has been directed against the Commissioners. The spirit of laudation in which he approaches this part of his subject has brimmed over to an enthusiastic advertisement for the Midland Re-afforesting Association, which, he says, "has already proved the feasibility of afforesting the shale heaps of the Black Country." The object of the Association is æsthetic, covered for propagandist purposes by a thin

[1] Cd. 7488, p. 64.

economic veneer which, in our opinion, is mistaken. We hasten to add that for the work of the Association we have the utmost admiration; their task, however, is not economic afforestation, but to make the Black Country less unsightly and more fit for human habitation, and we are grieved at the apathy with which their efforts are in general regarded by the class that has benefited most by the desolation which industry has created.

We may pass briefly over the section dealing with the war period, although we have noticed some statements which appear to us extravagant. It is not, for example, a fact that "with the submarine campaign and the increasing demands made on tonnage [timber] imports gradually dwindled, until they became practically negligible." Nor is it true that "the Russian supplies ceased with the closure of the Baltic, and those from France with the calling of the woodcutters to the colours."

Part III., the largest, of Mr Stebbing's book deals with "The Future," and is doubtless the *raison d'être* of the work. Here the author discusses the problem mainly as one of economics. We gather that he favours the economic doctrine of protection. He believes that this country is totally dependent on abroad for timber, and that "this dependence . . . has meant, and will mean for some years to come, that considerable sums of money annually leave this country for the purchase of timber, and, worse still, manufactured timber—sums of money which might have gone into the pockets of our own people." And he proceeds to generalise his argument:

"All the nations have become alive to the fact that the road to wealth and the surest way to successful development in the social progress and the amelioration of the conditions of life of their peoples, is by the conversion and manufacture of their raw products, before export, within the country itself. By this means plenty of assured employment is provided for their own people, the money expended on the conversion and manufacture goes into the pockets of their own people, and is put there by the foreigner who has to purchase these imports. This applies to timber imports as much as to anything else."

It has never occurred, we presume, to Mr Stebbing that there is any mutual advantage in foreign trade at all: that if nations did not import they would not export: that Great Britain is a big exporter of "raw products," in particular, coal, and that if she

were not we should all be very much worse off. He may find it difficult to believe that considerable sums of money do *not* annually leave this country for the purchase of timber or anything else, but nevertheless the fact is so. If all nations were to live up to his ideal of self-supporting communities, each refusing to export raw material, the population of these islands would be perhaps one-tenth of what it is to-day, and the problem of afforestation would wear a very different aspect. We cannot follow Mr Stebbing through, what seems to us, the morass of economic fallacies in which he embeds his arguments, but he appears to believe that if a purchaser is not a producer of a certain article he has no control over the price of that article, and that he is at the mercy of "a monopoly" (p. 109), although Mr Stebbing must have bought oranges, bananas, tea, and many other exotic commodities at very low prices before the war, and will do so again, we assure him, before many years are over: he is satisfied that "a number of industries in the absence of their chief material, wood, would come to an end," including, we gather, the construction of railways, tramcars, omnibuses, carriages, and motor cars—although he must know that the use of any particular material for a purpose depends upon its comparative accessibility and cheapness, and that it is quite possible yet to substitute other materials for timber, as in the past timber houses gave way largely to brick, and wooden ships to iron and steel.

We are glad to find ourselves in agreement with Mr Stebbing when he says that if the British people are serious in their attitude towards the League of Nations "we can no longer appeal for the support of the public in this afforestation matter, giving as our main argument the national safety point of view." We regret all the more his facile taunts cast at a defeated enemy; "these barbarians" (p. 95) should be made to pay "part of the indemnity . . . in timber, and timber calculated at the prices in force at the outbreak of war" (p. 91): but perhaps Mr Stebbing's economic misconceptions prevent him from appreciating the dishonesty of such a transaction, although the barbarian of tradition might well shrink from it. However, these patriotic sentiments, even several times repeated, do not affect the main economic argument to which we will return in concluding our notice.

The case for afforestation is not, we venture to suggest, to

be found in arguments for national self-sufficiency or in alarmist views as to price, nor indeed does Mr Stebbing limit himself to these arguments. The plain fact is that timber prices have followed the main trend of general prices,[1] and will do so again, we do not hesitate to predict, for some considerable time as soon as economic conditions have settled down after the war. Whether the price of timber will at some period rise sharply in relation to other commodities is a question upon which it is impossible to prophesy: among the factors to be taken into consideration are the planting and conservation of forests all over the world, the preservative treatment of timber, and the utilisation of alternative substances, *e.g.* metal for constructional purposes, grass and other fibres for paper; on the other hand, the fact that the consumption of timber per head of population appears to rise with economic development has to be taken into consideration.[2] But these questions are world questions, and although afforestation in this country might mitigate the consequences to us of world mismanagement or disaster, the mitigation at best would be but slight so long as these islands retain their present population and use timber to the same extent. We cannot be independent in this respect or in many others of vital consequence to the nation; for good or evil an island industrial community is bound to the world and its interests are the world's interests. In one sense, the Reconstruction Sub-Committee were right when they advocated afforestation as a measure of insurance in case of war: this is a strong argument, while the economic arguments frequently used are weak or fallacious: indeed, the future peace of the world is not so assured that we can afford to neglect it. But there is a better argument which equally we cannot afford to neglect, and that is that in its own interest as well as in the interest of all the communities of the world no nation can afford to fail to utilise its resources or to improve the conditions of its people. Britain, as part of a world-community needs timber, and the nation should grow it wherever it can be economically grown to the extent to which the land is better adapted for this than for any other purpose: if afforestation will add to the number of healthy and prosperous people in these islands, that also is in the interests both of Britain and the world. We need not, with

[1] Cf. Cd. 7488, pp. 77, 78.

[2] Ibid., pp. 75, 76.

our British horror of exalted sentiment, even pretend that we pursue altruistic ends: it will pay us and pay all other nations if we are all producing as much as possible and are as healthy as possible: just as it is advantageous to be healthy and prosperous oneself, and to live near healthy and prosperous neighbours. This is, briefly, the best argument for afforestation: but, Mr Stebbing may be quite certain, we shall not long be healthy or prosperous if our neighbours are poor and unhealthy, and if we refuse to buy or sell with them: we shall all be poor together or prosperous together, all healthy or unhealthy together: it is all doubtless very sad, but so it is.

Here we fear that we must leave Mr Stebbing's book which, if not suggestive in the usual sense, is at least provocative. There are many points which we should like to challenge, but to do so would be to write a commentary as long as the book itself.

22. Red Pine or Norway Pine (*Pinus resinosa*).

(*With Plates.*)

By James Kay, Forestry Branch, Ottawa.

From the commercial standpoint the red pine is a very important timber tree, and it is found widely distributed over North-Eastern America. It ranges from Nova Scotia through Southern Quebec and Ontario to the valley of the Winnipeg River. In the United States it is found from the Lake States to Massachusetts and the mountains of Pennsylvania.

It never forms large pure stands, these being rarely more than 50 to 100 acres in extent throughout its range. It is only found pure on sandy and dry rocky ridges, reaching its best development, however, on deep, light, sandy loam; therefore it is not exacting as to soil requirement. Throughout its range it is associated with white pine, jack pine, and hardwoods (aspen and birch in the openings).

Botanical characteristics.—The leaves are in twos, slender, soft, flexible, dark green, and lustrous, 5 to 6 inches long, falling off about the fourth to fifth year. It flowers in May and June.

The cones are ovate, conical, 2 to 2½ inches long, maturing in the second autumn, shedding their seed in September and early October. Open-grown trees produce seed after the twenty-fifth year, those in stands from 45 to 60 years old.

The red pine, however, is not a prolific seed-bearer. In

Canada it produces seed at intervals of 5 to 7 years, after the twenty-fifth year; in the U.S.A., it seeds every 3 to 4 years. According to the U.S. Forest Service, a bushel of cones will average one pound of seed—a pound contains 55,000 to 70,000 seeds, with a germination of 89 per cent.. In Ontario, red pine seed was found to average 0·26 of a pound to the bushel, and 52,000 seeds to the pound, with a germination of 90 per cent. The average number of seeds per cone was found to be 37. Seedlings prefer a mineral seed-bed, do not stand shade, but are very hardy. Red pine seedlings do best with full exposure to light; they are more intolerant than those of white pine, but less so than jack pine.

With its associates, white pine will seed up the ground ahead of the red pine, owing to its greater degree of tolerance. Re-seeding by red pine, to be certain, will depend to a great extent on the condition of the soil and the forest cover. If fire has run over the tract, jack pine will come away first, as it seeds every year, and the heat of the fire releases the seed from the cones, thereby enabling it to get a start of its associates.

The U.S. Forest Service say:—"The intolerance of red pine is indicated by the occurrence of its reproduction: under a shade density of over 0·5, as a rule, it does not reproduce; it begins to reproduce abundantly when the density falls to 0·3."

In the thicket and polewood stages, its growth is very rapid, eventually reaching a height of from 70 to 120 feet, with a diameter of 2 to 3 feet. The branches are formed in whorls, are thick and spreading, covering the young stem to the ground, and forming an irregular pyramid, assuming a rather open crown at maturity.

The bark is very similar to that of Scots and Austrian pines. On young trees the bark is dark brown, thin, and scaly, becoming thick ($\frac{3}{4}$ to $1\frac{1}{4}$ inch) on older trees, reddish brown, and slightly divided by shallow fissures into broad, flat ridges, covered by thin, loose, light scales. The root-system is deep, with tap-root, giving off stout-branched lateral roots in regular succession, thereby ensuring wind firmness. In Ontario, where the red pine reaches its best development in Canada, the rainfall varies from 20 to 45 inches, with temperatures ranging from 105° Fah. in summer to 50° Fah. in winter. From U.S. records it appears that in some parts of the Lake States where it grows, there are frosts every month of the year, but the foliage of

PURE RED PINE STAND, RATHER OPEN, ON SANDY SOIL.

RED PINE (OVER MATURE) ON ROCKY RIDGE.

RED PINE ON PURE SAND.

[*To face p.* 158.

RED PINE, 90′ HIGH, GROWING IN PURE SAND, CHALK RIVER, ON CUT OVER LAND. RED PINE IN DISTANCE.

FULL STAND OF RED PINE ON PURE SANDY SOIL, 40′-50′ HIGH, ABOUT 30-40 YEARS.

[*Forestry Branch Photo.*

mature trees is immune to cold, though seed production may be affected.

The ground cover is a good indication of the soil quality and the crop that it is best fitted by nature to produce. The following plants are typical of the soil in which red pine were making splendid growth :—

ERICACEÆ (Heath Family).

Pyrola chlorantha.

,, *americana.*

,, *elliptica* (shin leaf).

,, *secunda.*

Moneses uniflora (one-flowered pyrola).

Gaultheria procumbens (winter green; checkerberry).

Chimaphila maculata (spotted evergreen).

,, *umbellata* (prince's pine; pipsissewa).

Epigaea repens (trailing arbutus; mayflower).

VACCINIUM (Blueberry).

Vaccinium canadense.

CLUB-MOSSES.

Lycopodium obscurum (club moss; three varieties observed).

MOSSES.

Polytrichum commune and *Hypnum.*

RUBIACEÆ (Madder Family).

Mitchella repens (partridgeberry).

LILIUM (Lily Family).

Polygonatum biflorum (Solomon's seal).

Maianthemum canadense (Canada mayflower; false lily of the valley).

CORNACEÆ (Dogwood Family).

Cornus canadensis (bunchberry; dwarf cornel).

Epipactis pubescens (rattlesnake plantain).

The wood of red pine is light (32 lbs.), strong, tough, straight grained, easy to work, reddish in colour, rather like white pine before seasoning; after seasoning red pine is darker in appearance, due to its having more resin in its make-up.

There is a marked difference between the weight and quality of lumber cut from young stands and from mature timber, due to the percentage of sapwood in the former. Sargent gives the specific gravity of dry wood as 0·485. The sapwood of young trees has a specific gravity of 0·9, and the heartwood 0·6.

The timber of red pine has wide uses; from its uniform

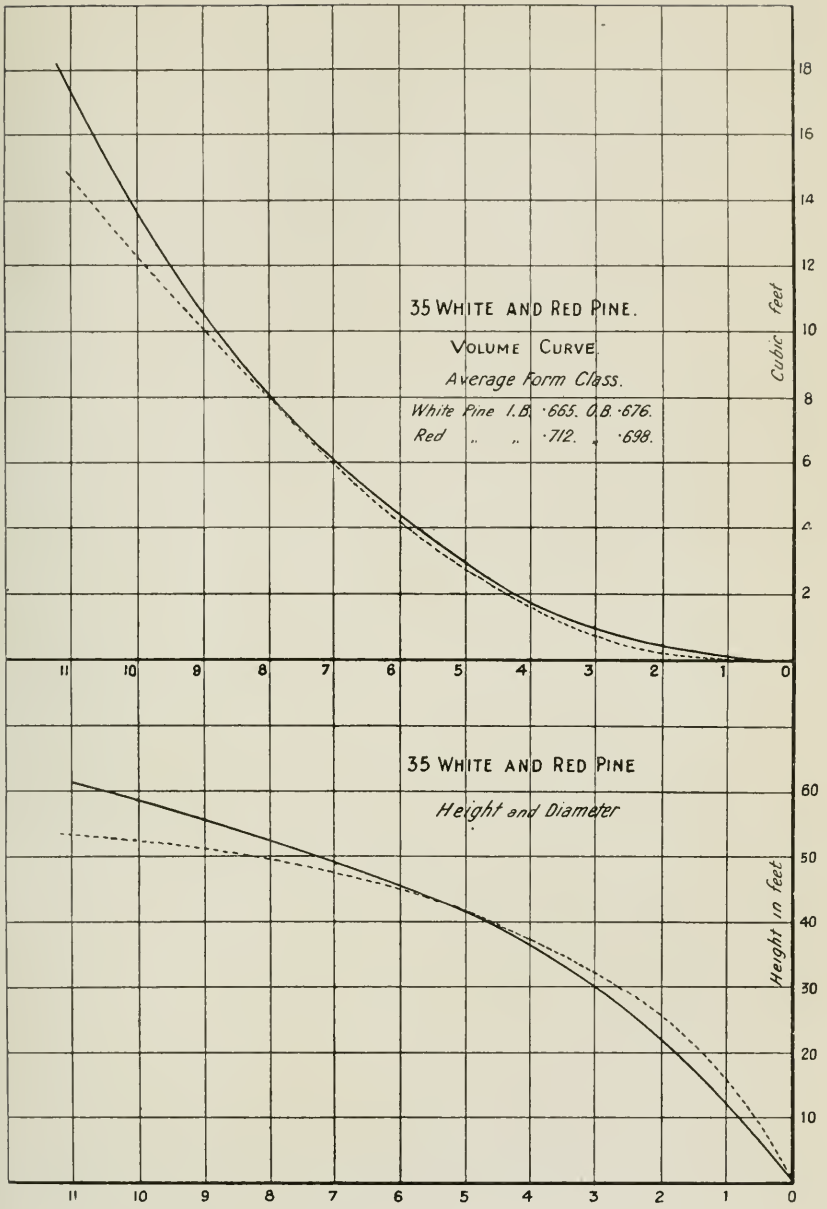
structure, density, and similar appearance, it is often classed and sold as white pine. It is considered by lumbermen that there is not enough difference in the physical properties of the two pines to warrant their separation on the market. It is largely used for dimension stuff, in bridge building and house construction, farm implements, car construction, furniture, doors, sashes, sleepers, poles, posts, etc.

The red pine closely resembles the Scots and Austrian pines in its silvicultural characteristics. From its ease of propagation; its ability to make rapid growth on pure sands quite unsuited for agriculture; the value and wide uses of its timber (almost if not equal to white pine); its wide range, hardiness, freedom from serious insect and fungi attacks, and resistance to fire, it forms a very desirable species for reforestation in the future. From the standpoint of forest management, this species, possessed of so many good qualities, will be sure to take a large place in the economy of the forest, when its good qualities become better known and duly appreciated.

COMPARATIVE TABLE OF WHITE AND RED PINE.

White Pine.

F.F.	F.Q. (i.b.)	F.Q. (o.b.)	d.b.h. 4·5	Volume	Age	Height
			inches	cub. ft.	years	feet
·524	·647	·667	3	1·22	36	37
·454	·578	·603	3	0·81	31	32
·543	·719	·705	4	2·05	27	41
·445	·581	·589	4	1·91	38	43
·435	·549	·612	5	2·11	41	41
·549	·740	·743	5	3·28	36	44
·518	·717	·714	5	3·06	31	39
·472	·602	·605	5	2·90	27	39
·491	·643	·655	7	5·38	30	41
·516	·686	·682	7	5·93	37	43
Averages ·494	·650	·657	4·8	2·87	33	40
			Red Pine.			
·540	·666	·660	4	1·37	36	36
·562	·745	·740	5	3·39	36	46
·550	·717	·714	5	3·35	39	40
·583	·734	·730	5	3·03	38	44
·559	·734	·724	6	6·34	38	51
·585	·755	·754	6	4·35	38	45
·543	·736	·726	7	7·33	35	50
·528	·718	·700	8	8·64	36	49
·504	·589	·560	9	10·34	36	46
Averages ·550	·710	·701	6	5·35	37	45


35 WHITE AND RED PINE.
VOLUME CURVE.
Average Form Class.
White Pine 1.B. ·665. O.B. ·676.
Red ,, ,, ·712. ,, ·698.
Cubic feet
18
16
14
12
10
8
6
4
2
11 10 9 8 7 6 5 4 3 2 1 0
35 WHITE AND RED PINE
Height and Diameter
Height in feet
60
50
40
30
20
10
11 10 9 8 7 6 5 4 3 2 1 0
D.B.H. O.B. inches.
White Pine ——— Red Pine - - - -

[To face p. 160.

The data for this table are taken from *Complete Stem Analysis* (inside and outside bark). The "Absolute Form Quotients" were worked out by the method given by Professor Tor Jonson, Professor in Mensuration and Forest Mathematics of the Royal Forestry College, Stockholm.

NOTES AND QUERIES.

Importance of Burning Brushwood.

The following notes of my experience in regard to above, may serve to show that (1) prompt attention to burning will prevent serious destruction by weevils and beetles, and (2) if circumstances prevent such adequate burning loss of valuable young plants and labour is the inevitable consequence.

For twenty-five years, or thereby, I was able to pursue (annually) the regular plan of burning dead branches and brushwood unsuitable for firewood. But the violent gales of November 1909, and November 1911, and of April 1912, blew down such quantities of trees, large and small, and left them lying in so many directions that there was much difficulty in dealing with the timber; and masses of brushwood had to be left lying. Then came the war, with increased demand for timber to be felled, and all the difficulties of obtaining adequate labour. It was, however, possible to burn the brush and clear certain areas for planting; but on one section of Bargane Hill, 400-500 feet above sea-level, a large area of tangled young trees remained undealt with, while at the same time it became necessary to risk planting an adjacent area with larch and Scots pine. In July following, numbers of pine weevils appeared. As many as possible were captured, placed in bottles and destroyed. In the following April the pests re-appeared in increased numbers, and again (though less numerous) in July.

Result: 30-40 per cent. of the young plants have been destroyed, and nearly half the work has to be done over again. The larch plants suffered the greatest amount of damage, whole sections of them having been altogether destroyed.

James Farquharson.

Ardgowan, Renfrewshire.

Douglas Fir for Railway Sleepers.

The following extract from a communication of the Chief Engineer of one of the great American Railway Companies is of considerable interest in this country, where experiments have already indicated that home-grown Douglas fir possesses in a high degree the necessary technical qualities to justify its use for railway sleepers:—

"The life of sleepers in Douglas fir is about eight years, but this figure may vary considerably according to local conditions and the moisture and nature of the soil. Douglas fir has a carrying strength of 5000 to 8000 livres (pounds) the square inch. The elastic modulus is about 1,600,000 square inches.

"Where traffic is considerable we find it necessary to use iron wedges ("coussinets") under the rails. This wood holds the iron bolts solidly and is easily worked.

"We generally treat it by the 'zinc chloride' process which adds from two to three years to the life of the sleeper. I have never seen a sleeper perish after having been so treated. Life of sleepers so dealt with is only terminated by mechanical wear and tear. Douglas fir wood may be treated by the zinc chloride process or by other salts of a like nature, but it cannot well be treated with creosote though one may obtain good results if the process is very carefully carried through.

"Taking into consideration the enormous quantity of Douglas fir in our locality this is the only kind of wood we use for making the railroad, and, generally speaking, the results are perfectly satisfactory, looking to the price and lasting qualities of the wood."

Forestry in Western Australia.

The *Report* of the Woods and Forest Department of Western Australia, for the half-year ended 30th June 1918, which has been recently published, brings out incidentally some curious indirect effects of war conditions. In the Commonwealth, as a whole, the timber industry during the period was in a depressed condition, the Eastern States especially suffering from the lack of imported timber from America, owing to the shortage of ships. But this has led to a better demand for Western Australian timbers in South Australia and Victoria. In South

Australia, notably, karri timber has sprung into prominence for structural purposes. This new demand has made it necessary to give consideration to methods of avoiding waste of timber resources. Among wasteful practices the methods used by the hewers and firewood licensees may be mentioned. Hewing is a very wasteful form of conversion, the hewer recovering at best only 30 per cent. of the round log, and on an average only 25 per cent. In the years before the war, however, the hewers had been permitted to roam over the country, operating in any area they chose. They were able in this way to earn as much as £1 a day, but the practice of hewing in regions where milling is possible means a loss to the State of £1 for every load of timber hewn. By the permit system an attempt is being made to confine hewing to areas where milling is not practicable, that is where it pays better to take the axe to the tree than the tree to the mill, and legislation is to be brought in to exclude the hewers from the prime jarrah belt. Similarly firewood permits are intended to restrict the cutters to particular areas where their operations can be controlled, in place of allowing them to roam through the forest at will.

A new development, the result of prolonged negotiations with the Federal Government, has been the establishment of a shipbuilding yard in Western Australia for the building of six ships for the Commonwealth Government. The ships are to be constructed mainly of jarrah, karri being used for deck beams and other work above the water-line. There is no doubt that had more inter-state shipping been available during the war, a very large trade in timber might have been established between Western Australia and the Eastern States.

For the half-year the revenue of the Department amounted to over £22,000, and the expenditure to about £6000. Since the inception of the Department in 1895, the revenue has exceeded the expenditure by the large sum of £483,000.

Prolonging the Life of Wooden Poles.

Mr C. R. Harte, writing in the *Electric Railway Journal*, describes various means of prolonging the life of wooden poles and discusses their relative advantages, whilst pointing out

how different preservations keep out and destroy destructive germs.

The fresh sapwood of white pine is 50 per cent. water (of which 60 per cent. is sap, 35 per cent. is in the cell walls, and 5 per cent. is in the cell contents). The heart-wood contains a much smaller percentage of water, but what is there is sealed in so that it is difficult to eliminate. Preliminary soaking in water accelerates the rate of air-drying by removing much gum and mineral matter. Though the primary objects of seasoning are to cut down the food supply of decay fungi and render the wood more receptive to preservative chemicals, the reduction in weight is an important consideration from the point of view of freight costs.

Very careful temperature control is necessary with kiln drying, and the dried timber should be impregnated at once, to prevent reabsorption of moisture.

A prolonged series of measurements by the United States Forest Service shows that the external circumference of poles is practically unaffected by seasoning, even where there is heavy checking.

Oil paint protects a smooth dry pole against decay, but the paint is easily broken through, and does more harm than good to imperfectly seasoned poles by entrapping moisture. Tar gives a more elastic coating and some antiseptic effect, but the penetration is poor, and internal decay occurs almost as badly as with oil paint. Concrete sheathing is costly but effective, apparently owing to absorption of salts from the green concrete. Charring is uncertain in action, weakens the pole, and increases the fire risk.

There are two groups of antiseptics, viz. mineral salts and oils. The great disadvantage of the mineral antiseptics is that they are soluble in water and are quickly leached out. The author discusses the characteristics of creosotes from other sources than coal tar, and describes the high pressure "full cell" and the "empty cell" methods of applying preservative. A table is given comparing standard specifications for various creosotes. Notes are included on the methods and special features of all other preservative treatments now in common use.

Methods are described for repairing poles already decayed at the ground line. Whether the old pole is repaired or a new

one installed, it is important to sterilise the surrounding soil. The simplest method is to reinforce the weakened pole by setting a stub alongside.

Forestry in South Africa.

According to the *Annual Report* of the Forest Department of the Union of South Africa for the year ended 31st March 1918, the Union, owing to the scanty area under wood, has felt the pinch of war conditions more severely even than Australia and New Zealand. Planting has, however, been carried on on a considerable scale, especially by private enterprise. Even when the national forests of the Union, however, are brought to a high state of productivity, which will take a long time, they will not supply more than 5 per cent. of the probable future requirements of softwood timber, which comprises 90 per cent. of the consumption. It is, therefore, satisfactory to note that, in addition to the ordinary funds provided in the Revenue Estimates, a sum of £50,000 was granted for the year 1918-19 for afforestation purposes. During the year under discussion 2065 acres were afforested, in addition to 1566 acres at Railway Sleeper Plantations. A considerable amount of land also received preliminary cultivation with a view to planting during the following financial year.

As regards the comparison between indigenous forests and plantations, it is noted that the revenue from the latter is almost double that from the former, and more than double if railway plantation returns are included. For the year the return from the indigenous forests was nearly £23,000, and from the plantations, including the railway plantations, nearly £49,000.

REVIEWS AND NOTICES OF BOOKS.

Regional Spread of Moisture in the Wood of Trees—I. Deciduous-leaved Trees during the Period late Autumn to Early Spring. By W. G. Craib. *Notes from the Royal Botanic Garden, Edinburgh.*

Researches as to the amount and distribution of water in the tree at different seasons have been conducted on the Continent

and in the United States, but not in Great Britain. Yet such investigations in this country are called for, not only by reason of their physiological and ecological significance, but also because they have a bearing upon the practical problems of the felling season of trees and the seasoning of timber. Mr Craib's paper is therefore particularly welcome.

His detailed results cannot be readily summarised, but special attention may be directed to his series of facts relating to the sycamore during the "resting" season and opening of the "active" season (October to March). His results appear to indicate that, in the trunk of the sycamore, from October to February, a maximum amount of water lies in the central wood, which in March is so depleted as to become the driest portion; they showed in the central wood at different heights up the trunk a change of distribution of water from October, when the water showed a decrease in amount upwards, until March, when the reverse had become the case. Again the outer few annual rings contained much water in October, but in the succeeding months a migration of water took place, so that in March the outermost two annual rings were comparatively dry and a maximum amount of water was found just internal to these rings. It is therefore clearly indicated that considerable, and apparently periodic, movements of water take place in the trunk of the sycamore during the winter. Curves and excellent coloured diagrams supplied with Mr Craib's paper graphically record his results concerning the sycamore. Briefer notes are recorded in reference to *Platanus acerifolia*, *Betula verrucosa*, and *B. pubescens* × *verrucosa*, *Crataegus Oxyacantha*, *Ulmus montana*, and *Quercus Cerris*.

In interpreting Mr Craib's results, it is necessary to note that the amount of water present in the wood was estimated and recorded as a percentage by weight in reference to the *weight* of the absolutely dry wood in which the water was originally present. Yet from a physiological standpoint the fundamental feature is the amount of water present in a definite *volume* of wood. The quantity of water present in a given volume of wood is proportional not only to the percentage (as estimated by weight) present but also to the "specific gravity" of the wood: moreover, if it be assumed that a definite percentage (by weight) of the contained water is held so firmly inside the substance of the lignified walls as to be otherwise unavailable physiologically,

then, at a given percentage of water, the amount of physiologically available water contained in a unit of volume of wood is also proportional to the "specific gravity" of the wood. As the "specific gravity" of the wood of sycamore (and other species) varies from place to place in the same trunk, it follows that the adopted method of recording the amount of water present as a weight percentage does not alone indicate the quantity of water present or available in a given volume of wood: for instance, if in two regions of a trunk the recorded percentages of water be respectively 50 and 40, but the specific gravities of the wood be respectively ·4 and ·5, then in reality equal volumes of wood in the two regions contain exactly the same amount of water. The extent to which this volumetric method of assessing the amount and distribution of water in the wood might modify the interpretation of Mr Craib's results cannot be gauged in the absence of the required additional and laborious measurements, which, in any case, could not deprive of their value the significant facts discovered by Mr Craib.

It is satisfactory to learn that Mr Craib intends to continue this line of research, and the hope may be expressed that in a future paper he may be willing to summarise the information already published on this subject by workers in other countries.

PERCY GROOM.

Seaside Planting. By A. D. WEBSTER. London: T. Fisher Unwin, Ltd. Price 18s. net.

Mr Webster in the preface states that "This book has been written in order that the possibilities of seaside planting and benefits therefrom, both in a direct and indirect way, may be appreciated." The object is laudable. The benefits of seaside planting to the neighbouring country cannot be overrated. Plantations afford shelter from sea-blasts, and frequently help to stay the advances of sand-dunes. The author sets forth in this work the results of his experience and observations. He devotes a considerable amount of space to questions relating to the preparation of the ground, and the choice of species, not only of trees and shrubs, but also of climbing, wall, alpine, and herbaceous plants. He advocates trenching chalky and calcareous soils, peat and mud flats, and clays previous to planting. Before following this recommendation it would be advisable

always to count the cost, and to consider if success might not be had by cheaper methods. Pre-war charges for trenching, up to £20 per acre, do not leave much chance of direct financial profit from planting.

For fixing drifting sands preparatory to planting several excellent methods are given, but the treatment of this matter is not so exhaustive as it might be.

The recommendation that planting should not be done till late spring is sound, since it would not seem wise to expose newly inserted plants unnecessarily to the rigours of the winter's storms. The need for protecting the roots of plants during planting operations is rightly emphasised. Among conifers the author considers the most suitable for seaside planting are:— *Pinus Pinaster*, *P. Laricio var. austriaca*, *P. Laricio*, *P. montana*, *P. insignis*, *Cupressus macrocarpa;* and among hardwoods *Quercus Ilex*, *Acer Pseudoplatanus*, *A. platanoides*, and a few species of poplar and willow. It cannot be agreed that, "For planting along the most exposed part of the coast of Scotland and the Isles the palm of honour must be awarded to *P. Pinaster*." Its hardiness, under all the conditions that prevail there, is open to doubt. Unfortunately also, contradictory statements are made as to the best methods of raising *P. Pinaster*. On p. 31 it is stated that, "Although seed-sowing has been found a cheap and excellent method of getting up the cluster pine on the Continent, yet in this country planting young trees, unless in a few instances, has been found preferable"; and on p. 57, "Seed-sowing is preferable to using young plants in the case of *Pinus Pinaster*, gorse, broom, and several of the sand-binding grasses."

The author probably pays too little attention to *Pinus Banksiana*, although from the description given it might be doubted if he has any accurate knowledge of this tree. Certainly it would be difficult to recognise it as a tree "of low, straggling habit, rarely exceeding 20 feet in height, and much in the way of the better known *P. montana*."

There is a considerable amount of unnecessary repetition throughout the book. *Cratægus* is twice described, and the Culbin Sands are, in particular, referred to with some redundancy. Slips or errors in geography are not unknown. It has not been possible to trace a Forres, or an Island of Scurba, on the west coast of Scotland, nor a Lewis in Skye.

The author is not happy in his chapter on insect and fungus

diseases. In every case the description is poor, and at the outset he makes inexact statements regarding the pine beetle. An entomologist would not always see eye to eye with the author when he states that this beetle, after tunnelling in the shoot, makes its exit at the terminal bud. Nor would he agree that the insect is so wary that great care must be exercised in collecting the attacked shoots lest the creatures escape. In any case, the collection and burning of these shoots would be tedious work of no great utility in exterminating the insect. Of more benefit for reducing the numbers of this and other insects is, as the author insists, the removal of dead and dying wood.

Although there is a considerable store of information in this book, the reviewer is of the opinion that there is still room for a first-class work on the subject. M.

The History of the London Plane. By A. Henry and M. G. Flood. *Proc. Roy. Irish Acad.*, xxxv. Section B., No. 2, 1919.

The merits of the London Plane—*Platanus acerifolia*—for town-planting are too well known and too widely acknowledged to need recapitulation. Its origin has frequently been debated, and in this recently published article, by Professor Henry and Miss Flood, we are provided with a satisfactory account of its hybrid nature.

After a brief account of hybrid characteristics possessed by the London Plane, Professor Henry gives evidence for concluding that the tree was raised first at the Oxford Botanic Garden not later than 1670. This date corresponds well with the age of the famous Ely Plane planted by Bishop Gunning between 1674 and 1684. The characters of the genus are fully discussed, with numerous notes on reliable characters for delimiting the plants. One of these characters is a coefficient of lobing, which, from the figures tabulated, brings out in a very marked degree a difference between the two parents—*P. occidentalis* and *P. orientalis*—and also shows how some of the hybrids of the second generation approach one or other of the parents, and some are intermediate.

Full descriptions are given of the two parents, of the hybrid of the first generation—*P. acerifolia*—and of six hybrids which

belong most probably to the second generation. Of the latter, *P. parviloba* and *P. cantabrigensis* are new hybrids, described here for the first time.

Following up Benedict's work on the relationship of the age of the vine to the area of the "vein-islets" of the leaf, the authors seek to prove that since numerous leaves from different trees gave practically the same vein-islet area all London Planes are of the same age, being ultimately cuttings from one original tree. In conclusion, a synopsis is provided of the six known species of *Platanus*.

The paper is copiously illustrated with reproductions of photographs of twigs and with drawings of various achenes, and, in the case of *P. occidentalis*, with drawings of the vein-islets of the leaf at different ages of the tree.

Afforestation. By A. D. Webster, author of *Seaside Planting*, *Firewoods*, etc. 160 pp. T. Fisher Unwin, Ltd. London, 6s. net.

Mr Webster's views on afforestation are already well known to foresters, from his articles in magazines and in his useful and popular *Foresters' Diary* the current issue of which, by the way, is now unobtainable, having been sold out some time ago. His original scheme provided for the planting of 3,000,000 acres in twenty-five years at the rate of 120,000 acres per annum, but latterly he reduced this extent to 1,000,000 acres. In these circumstances it is not surprising that he thinks the area to be afforested under the Government scheme is too small, and the period over which the planting is to extend is too long.

The book consists of fourteen chapters, each dealing with some aspect of afforestation, such as the cost of forming plantations, the different methods of planting, the kinds of trees to plant, financial returns, the advantage of afforestation, schools of forestry, and other matters. The volume contains a good deal of useful information, but is marred by repetitions which should have been avoided. The articles should have been revised by the author before they were sent to the printer and the repetitions deleted. As they stand the remark we observed in a contemporary regarding a similar volume of articles might be applied to them, "It is chiefly because of the bookbinders' art that they form a volume."

Royal Scottish Arboricultural Society

(INSTITUTED 16th FEBRUARY 1854).

LIST OF NEW MEMBERS elected since the publication of the Diamond Jubilee Volume in 1914.

HONORARY MEMBERS.

Date of Election.

1918 ANTONI, Paul, Sousdirecteur des Eaux et Forêts, Paris.

1918 BUFFAULT, Colonel Pierre, Inspecteur des Eaux et Forêts, Centre de Bordeaux, France.

1918 CARLSON, K. A., Orange River Conservancy, South Africa.

1918 GRAVES, Colonel Henry S., Chief of Forest Service, Washington, U.S.A.

1918 HIRST, Edgar C., State Forester for New Hampshire, U.S.A.

1918 RENWICK, John, 9 Crosbie Street, Maryhill, Glasgow.

1918 ROBINSON, R. G., Department of Lands, State Forest Branch, Tapanui, Otago, New Zealand.

LIFE AND ORDINARY MEMBERS.

* *indicates Life Member.*
Italics indicate that present Address is unknown.

LAW V. Members in arrear shall not receive the *Transactions*. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

Date of Election.

1918 ... *ABBOTT, Harry, Forester and Timber Surveyor, Isel Cottage, Cockermouth.

1919 ... ADAM, Alexander, Forester, Ordhead Cottage, Cluny.

1918 ... ADAMS, Edward Joeceline Percy, Forestry Department, 10 George Square, Edinburgh.

1918 ... AITKEN, Alfred N.G., S.S.C., Edinburgh.

1918 ... AITKEN, John Malcolm, Factor, Norwood, Lockerbie.

1916 ... ALEXANDER, James, Farmer, Bent, Laurencekirk.

1916 ... *ALLAN, Arthur Acland, M.P., of Tullibelton, Perthshire.

1918 ... *ANCASTER, Earl of, Grimsthorpe, Bourne.

1915 ... ANDERSON, Charles, Assistant Forester, Hairmyres Nursery, East Kilbride.

1917 ... ANDERSON, George, Forester, Castle Leod, Strathpeffer.

Date of Election.

1917 ... ANDERSON, John Adam, Forester, Greens Cottage, Dunphail.
1917 ... ANDREWS, Clement W., Librarian, The John Crerar Library, Chicago, U.S.A.
1918 ... ANTROBUS, Sir Cosmo, Bart., Amesbury Abbey, Salisbury.
1918 ... *ARMSTRONG, James, Timber Salesman, 38 Hill Street, Garnethill, Glasgow.
1918 ... ARNOT, Thomas, Managing Director, United Collieries, Ltd., 109 Hope Street, Glasgow.
1918 ... *ARTHUR, James, of Montgomerie, Tarbolton.
1918 ... AULD, Miss Kathleen Maxwell, 79 Newton Street, Greenock.
1917 ... *AULD, William, Procurator-Fiscal, County Buildings, Greenock.
1918 ... *BAILLIE, James E. B., of Dochfour, Inverness.
1914 ... BAIRD, Andrew Thomas, Foreman Forester, Raslie, Poltalloch.
1918 .. BAIRD, Mrs J. G. A., of Colstoun, Haddington.
1918 ... BARR, John, Advocate, Dee Street, Aberdeen.
1916 ... BARBER, William, Land Court, 29 St Andrew Square, Edinburgh.
1918 ... BELL, Adam, Forester, Faldonside, Melrose.
1916 ... *BELL, Thomas, Engineer, Brincliffe, Helensburgh.
1918 ... *BERNARD, John Mackay, B.Sc., F.R.S.E., F.R.S.G.S., of Dunsinnan, Perth.
1917 ... BISSET, John (John Bisset & Sons), Ltd., Esplanade Sawmills, Aberdeen.
1915 ... BLACK, Lieut.-Col. George Hedger, B.L., V.D., Rossie, Collessie, Fife.
1918 ... BLAIR, Alexander Stevenson, W.S., 12 Charlotte Street, Edinburgh.
1918 ... BLAIR, Captain Edward Hunter, of Blairquhan, Ayrshire.
1918 ... BLAIR, Goodall, Secretary, D. MacAndrew & Co., Ltd., Woodville, Whitehall Terrace, Aberdeen.
1917 ... BLAIR, James Hunter, younger of Blairquhan, Maybole.
1918 ... BLUE, Alexander, Headmaster, Kildusklaud, Ardrishaig.
1918 ... *BOLTON, Edwin, of West Plean, Bannockburn.
1916 ... BOST, W. D. ASHTON, Chemical Manufacturer, Cartvale Chemical Works, Paisley.
1917 ... BOYD, William, Timber Merchant, Clarencefield, Ruthwell.
1918 ... BREINGAN, William, Forester, Dores, Inverness.
1915 ... BREMNER, John, Clerk of Works, Balmoral.
1918 ... *BROOKE, John Arthur, Fearn Lodge, Ardgay.
1918 .... *BROOM, J. Lindsay, Assistant Timber Merchant, Bathgate.
1918 ... BROWN, Alexander Murray (late Hon. Col.), Longformacus, Duns.
1915 ... BROWN, A. W., Timber Merchant, Bucksburn.
1918 ... BROWN, George, M.A., Schoolhouse, Littlemill, by Patna, Ayr.
1916 ... BROWN, Horatio F., of Newhall and Carlops, 28 Castle Street, Edinburgh.
1918 ... *BROWN, James, Netherby, Galashiels.
1918 ... BROWN, Matthew, Shotts Iron Co., 1 Castle Street, Edinburgh.
1918 ... BROWN, Robert, Mine Manager, Calderbank Ho., Baillieston, Lanarkshire.

Date of Election.

1918 ... Brown, T. Craig, Selkirk.
1916 ... Brown, Thomas, Wood Merchant, Buckhaven.
1918 ... Brown, Thomas Morris, Factor, Closeburn Castle, Thornhill, Dumfriesshire.
1917 ... *Brownlee, Robert, Timber Merchant, Merrylee House, Newlands, Glasgow.
1918 ... Bruce, Alexander, Estate Office, Kildrummy, Mossat, Aberdeenshire.
1918 ... Bruce, Robert, Sunnyside, Jedburgh.
1918 ... *Buccleuch, Her Grace the Duchess of, Dalkeith Palace, Dalkeith.
1918 ... Burgh, Lt.-Col. The Lord, Glenkindie, Aberdeenshire.
1917 ... Burt, Matthew Gillespie, Estate Factor, Wishaw Cottage, Wishaw.
1918 ... Burton, Miss Mary Elizabeth, Head Gardener, The Gardens, New Saughton Hall, Polton.
1918 ... Caird, James Alexander H., of Cassencary, Creetown, Kirkcudbrightshire.
1917 ... *Cameron, John, Timber Merchant, Shieldhall, Govan.
1917 ... Campbell, Sir Archibald S. L., Bart. of Succoth, D.L., J.P., Garscube, Glasgow.
1917 ... Campbell, James, Factor, Estate Office, Dunalastair.
1918 ... *Campbell, James Hugh, of Stracathro, Brechin.
1918 ... *Campbell, John Macdonald, Timber Merchant, Myrtle Cottage, Doune.
1918 ... Campbell, Matthew, Foreman Forester, Sawmill Cottage, Sorn Castle, Mauchline.
1918 ... Campbell, Miss Ruby D., 11 Gray Street, Glasgow, W.
1917 ... Campbell, Sir James, LL.D., D.L., 14 Douglas Crescent, Edinburgh.
1918 ... *Campbell, William Hobart, of Daldorch, Catrine, Ayrshire.
1915 ... *Cardross, R. Douglas Stuart Mar Erskine, Lord, Almondell House, Midcalder.
1917 ... *Carlow, C. Augustus, Joint Managing Director, Fife Coal Coy., Ltd., Leven.
1918 ... Carmichael, James Brown, Valuer, Inland Revenue, The Hall, South Brent, Devon.
1918 ... *Cayzer, Major Herbert Robin, of Lanfine, Ayrshire.
1918 ... *Chalmers, Alexander, Seedsman, 13 South St Andrew Street, Edinburgh.
1918 ... Chalmers, Lawrence M'Donald, Factor, Alford, Aberdeenshire.
1918 ... Chambers, Thomas, Glencairn, Uddingston.
1919 ... Chapman, David, Forestry Student, Birnam.
1919 ... Christianson, Charles Oscar, Clerk, 3 Laverockbank Road, Trinity.
1918 ... Christie, Ralph Lindsay, Estate Manager, Durie, Leven.
1918 ... Christie, Thomas North, Blackhills House, Lhanbryde, Morayshire.

Date of Election.

1916 ... Clapperton, John, Head Forester, Broomhall, Airthrey, Bridge of Allan.
1917 ... Clark, John, Head Forester, Gordon Castle, Fochabers.
1918 ... Clark, Miss Mary Emily Gilchrist, of Speddoch, Dumfries.
1918 ... *Clark, Sir John Stewart-, Bart., D.L., J.P., Dundas Castle, South Queensferry.
1917 ... Clark, Wm., Killincraig, Largs.
1919 ... Clerk, Henry Joseph, Timber Merchant, 15 Gordon Street, Glasgow.
1918 ... *Cobbold, John D., Rannoch Lodge, Perthshire.
1916 ... Connell, John Campbell, Shipbuilder, Scotstoun, Glasgow.
1918 ... Copland, Primrose C., Teacher, Schoolhouse, Dalton, Lockerbie.
1918 ... Cormack, William, Nursery Foreman, Pinewood Park, Nurseries, Aberdeen.
1918 ... *Cowan, John, Timber Merchant, Grangemouth.
1918 ... *Craib, William Grant, M.A., University Lecturer, 49 Queen's Avenue, Blackhall.
1916 ... Craig, Daniel Livingstone, Forester and Ground Officer, Yellow Cottage, Killin.
1918 ... Cree, William, of Kailzie, Peebles.
1919 ... *Crichton, James, B.Sc., Tower Building, Liverpool.
1919 ... Crichton, John Buttar, Land Steward and Gardener, Beechhill Nursery, Murrayfield.
1918 ... *Cross, Alexander, East Bank, Langbank.
1918 ... Cross, Robert, Cockburn Hill, Balerno.
1918 ... *Cross, Thomas, East Bank, Langbank.
1918 ... Cuninghame, Major W. S., D.S.O., Craigdarroch, Moniaive.
1918 ... Cunningham, Mrs, of Craigends and Dunragit, Wigtownshire.
1918 ... *Cunningham, Mrs St Clair, of Hallmanor, Peebles.
1918 ... *Dalkeith, The Earl of, Dalkeith Palace, Dalkeith.
1919 ... Deas, Adam, Land Agent, Briery Bank, Duns.
1917 ... *Denny, Leslie (Messrs W. Denny & Brothers,) Leven Ship Yard, Dumbarton.
1918 ... Dewar, De Courcy Lewthwaite, Studio, 93 Hope Street, Glasgow.
1918 ... Dick, William W., Timber Merchant, Ashfield, Hamilton.
1917 ... Dickson, Charles, Land Steward, Hazlehead, Aberdeen.
1917 ... Ditchburn, Gilbert Roy, 12 Nelson Street, Edinburgh.
1918 ... *Don, John Birrell, M.A., of Maulesden, Brechin.
1918 ... Drennan, Samuel J., Trawl Owner, 23 Starbank Road, Trinity.
1918 ... Duff, Major Robert W., of Fetteresso, Stonehaven.
1918 ... Duncan, Alex. Robert, Advocate, of Parkhill, Arbroath.
1918 ... *Duncan, Robert, of Dalchonzie, 9 Inverness Terrace, London.
1918 ... Dundas, Sir Henry, Bart., Polton House, Lasswade.
1919 ... Dundas, Robert Nevill, W.S., 16 St Andrew Square, Edinburgh.
1918 ... Dundas, William Claxton, Solicitor and County Clerk, Selkirk.
1917 ... *Dunlop, Robert Jack, J.P., Shipowner, Barkskimming, Mauchline.
1918 ... Dunlop, Sir Nathaniel, D.L., LL.D., of Shieldhill, Biggar.

Date of Election.

1918 ... ELLESMERE, The Earl of, Mertoun, p. J. Robertson, Estate Office, Morebattle, Kelso.
1918 ... ELLIOT, William Scott, Arkliton, Langholm.
1918 ... *ELLIS, John T., Timber Merchant, Fossoway.
1919 ... EMBLIN, Arthur Sanderson, Land Agent and Forester, Firth House, Brighouse, Yorks.
1918 ... *ERSKINE, Mrs Margaret Catherine, The Priory, Melrose.
1918 ... ERSKINE, Brig.-Gen. James Francis, jun., of Cardross, Cardross, Port of Menteith.
1918 ... *ERSKINE, Sir Thomas Wilfred Hargreaves John, Bart., of Cambo, Kingsbarns, Fife.
1918 ... EWEN, John, Foreman Forester, Nursery Cottage, Glenside, by Maybole.
1918 ... *FARINGDON, Baron, Glenalmond, Perthshire.
1918 ... FENTON, James Houston, J.P., Kair, Fordoun, Kincardineshire.
1918 ... *FENWICK, Featherstone, Forester's Lodge, Wolsingham, Co. Durham.
1916 ... *FIDDES, James, Wood Merchant, Torry, Aberdeen.
1918 ... FINLAY, Ian Archibald, Castle Toward, Argyll.
1918 ... *FINLAYSON, Alexander J., Overseer, Newbattle, Dalkeith.
1918 ... FLETCHER, Archibald Macphail, Factor, North Harris Estate Office, Tarbert, North Harris.
1918 ... *FORBES, Charles William, D.L., J.P., Callendar House, Falkirk.
1918 ... FORBES, George Duncan, Estate Office, Kennet, Alloa.
1918 ... FORBES, Lt.-Col. Ian, of Rothiemay, J.P., D.L., Rothiemay Castle, Banffshire.
1918 ... FORBES, Joseph, Forester, West Mill, Cortachy, Kirriemuir.
1918 ... *FORBES, Lord, Castle Forbes, Whitehouse, Aberdeenshire.
1918 ... *FORD, P. J., Advocate, M.A., LL.B., Westerdunes, North Berwick.
1918 ... FORMAN, Rev. Adam, M.A.(Camb.), Craigieland, Beattock.
1918 ... FORMBY, Commander Hesketh, The Cottage, Dalmeny.
1915 ... FORRESTER, John Stewart, Woodend Lodge, Kilmaronock, by Alexandria.
1918 ... FRASER, Alexander Scott, Factor, Annes Estate, Woodpark, by Elgin.
1915 ... FRASER, George Knowles, M.A., B.Sc., Student of Forestry, 50 Victoria Street, Stonehaven.
1919 ... FRASER, Peter, Land Steward, Sandbank Cottage, Tillicoultry.
1918 ... *FRASER-TYTLER, Major Neil, D.S.O., Aldourie Castle, Inverness.
1918 ... FFYFE, William, Head Forester, South Lodge, Whittinghame, Prestonkirk.
1918 ... GALLOWAY, The Earl of, Cumloden, Newton Stewart.
1917 ... *GARDINER, William Guthrie, Shipowner, 14 St Vincent Place, Glasgow.
1918 ... GIBSON, John, Sawmiller, Taoff Sawmills, Kirkcowan.
1917 ... GILLIES, Gilbert D., Head Forester, Lee and Carnwath Estates, Carnwath.

Date of Election.

1918 ... *Gilmour, Lt.-Col. John, D.S.O., Montrave, Leven.
1918 ... Glasgow, Commander The Earl of, Kelburn, Fairlie, Ayrshire.
1919 ... Glenarthur, Lord, of Carling, Fullarton, Troon.
1918 ... Golightly, John Philip Roderic, Land Agent (on service).
1916 ... Gordon, James Douglas, National Bank, Dalry, Ayrshire.
1917 ... *Gordon, Leslie, Timber Merchant, 12 Charles Street, Aberdeen.
1918 ... Graham, Alexander Drummond, Timber Merchant, Firhill Sawmills, Glasgow.
1917 ... Graham, James, Bellhaven Sawmills, Wishaw.
1916 ... Grant, G. R., of Auchnacree, Brechin.
1918 ... Grant, James, Consulting Forester, 34 Queen Street, Edinburgh.
1918 ... *Grant, James, Solicitor and County Clerk, 25 Castle Street, Banff.
1919 ... Grant, Robert Charles, Forestry Student, Birnam.
1916 ... Grant, William, Assistant Forester, Tomagrain, Dalcross.
1917 ... Gray, William, Forester, Dunsinnan, Perthshire.
1917 ... Greig, Peter M., Nurseryman and Seedsman, 6 Frederick Street, Edinburgh.
1916 ... *Grieve, A. N., Indian Forest Service, Chailussa Chota, Nagpur, India.
1917 ... Griffith, Thomas, Agent (to Earl of Ancaster), Gwydyr Ucha, Llanrwst.
1917 ... Griffiths, John William, Forester, 69 Bay View Terrace, Beach Road, Bangor.
1918 ... *Hall, Major William Macalister, of Torrisdale and Crossaig, Torrisdale Castle, Carradale, Argyll.
1918 ... Hamilton and Brandon, The Duchess of, Hamilton Palace, Hamilton.
1917 ... *Hamilton, Gavin, of Auldtoun, Lesmahagow.
1918 ... *Hamilton, George Findlay, of Carnell, Carnell, Hurlford, Ayrshire.
1918 ... Hamilton, Major North V. C. Dalrymple, of Bargany, Girvan.
1918 ... Hamilton, Major William Malcolm Fleming, of Craighlaw, Kirkcowan.
1917 ... *Hamilton, Mrs, Gardenhall, East Kilbride, Lanarkshire.
1917 ... Hamilton, Thomas Welsh, Estate Architect and Surveyor, F.S.I., Mansion House, Greenock.
1918 ... Hannay, Arthur Hubert, Assistant Forester, c/o Miss Dow, Murthly Terrace, Birnam.
1918 ... Harkness, James, Newfield Burn, Ruthwell.
1916 ... Harper, William, Head Forester, Home Farm, Galloway House, Garliestown.
1918 ... Harrower, D. K., Timber Merchant, Bo'ness.
1917 .. Hart, Maxwell Muir, Timber Merchant, 34 St Enoch Square, Glasgow.
1918 ... *Hay, Francis D., of Duns Castle, Duns.
1917 ... *Henderson, Alexander, Timber Merchant, 134 Pollok Street, Glasgow.

Date of Election.

1918 ... Henderson, John, Accountant, Rosebank, Spenser Road, Harpenden (Herts).
1918 ... Henderson, Miss Jean, 3 Dalziel Drive, Pollokshields, Glasgow.
1918 ... Heron, John, Wood Merchant, Ayton, Berwickshire.
1918 ... Highgate, John, Head Gardener, Hopetoun, So. Queensferry.
1919 ... Hiley, W. E., Forest Pathologist, Research Institute School of Forestry, Oxford.
1918 ... Hill, John Taylor, Timber Merchant, 82 Mitchell Street, Glasgow.
1918 ... Holme, Charles Henry, of Paull Holme, Yorks.
1917 ... Holmes, Emra, Estate Agent, Curlingwark, Castle Douglas.
1918 ... *Home, George, Forester, 120 Lindsay Road, Dublin.
1918 ... *Home, George, Forester, Newmill on Teviot, Hawick.
1918 ... Houldsworth, Capt. James Hamilton, of Castlebank, Lanark.
1916 ... *Houston, Laurence C., Retired Gardener, 52 Stirling Road, Trinity, Leith.
1918 ... *How, William Slavens, Factor, Culderry House, Garlieston.
1917 ... Howard, Robert James, Land Agent, Shear Bank House, Blackburn.
1918 ... Howie, Andrew Law, Timber Merchant, Oakholme, Dunlop.
1918 ... Hume, Col. Archibald, of Auchendolly, Dalbeattie.
1916 ... Hume, John, Valuer, P.A.S.I. & F.S.I., 30 Eastfield, Joppa.
1918 ... Hunter, George, Factor, Galloway Estate Office, Newton Stewart.
1918 ... Hunter, Lt.-Col. James, of Antons Hill, Coldstream.
1918 ... Hunter, Reginald Watt, N.D.A.D., Chief Assistant, Timber Supplies Department, 94 St George's Terrace, Newcastle-on-Tyne.
1918 ... Irvine, Lieut. Quentin Hugh Innes, of Straloch, Newmachar, Aberdeenshire.
1915 ... Irving, William, Estate Clerk, Broadbeck, Waterbeck, Ecclefechan.
1915 ... *Jackson, Henry, M.A. (Cantab.) F.S.I. School of Forestry, Cambridge.
1918 ... *Jackson, William, Engineer, 6 Montague Terrace, Glasgow, W.
1918 ... Jacob, James Lothian, Timber Merchant, 93 Hope Street, Glasgow.
1918 ... Jameson, Erskine Dawson, Solicitor, Elgin.
1918 ... Jardine, David Jardine, of Jardine Hall, Lockerbie.
1919 ... *Jardine, James L., Paper Manufacturer, Eskmills, Penicuik.
1918 ... *Jardine, J. W. Buchanan, Castle Milk, Lockerbie.
1918 ... *Jardine, Lady Ethel Mary Buchanan, Castle Milk, Lockerbie.
1917 ... Jeffrey, Thomas, Nurseryman, Windlestrawlea, Edinburgh.
1917 ... Johnstone, James, Advocate, 80 Union Street, Aberdeen.
1918 ... Jones, Walter, of Aberuchill, Comrie, Perthshire.
1918 ... Jesson, Lieutenant Roger, 3 Ranelagh Road, Winchester.
1918 ... Kelsall, Henry, National Service (Agric.), Bothendene, St Boswells.
1918 ... Kennedy, Andrew, Timber Merchant, 48 West Regent Street, Glasgow.

Date of Election.

1918 ... KENNEDY, William G., Timber Merchant, 48 West Regent Street, Glasgow.
1918 ... *KERR, Thomas, Timber Importer, 133 Copland Road, Govan, Glasgow.
1918 ... KERSS, John S., Factor, Comlongon Estate Office, Ruthwell.
1918 .... KETTRICK, John, Timber Merchant, Stirling.
1918 ... *KING, Sir John Westall, Bart., Carstairs House, Carstairs.
1918 ... KINNAIRD, The Lord, K.T., Rossie Priory, Inchture, Perthshire.
1916 ... KOON, Li Ying, Student, School of Forestry, Cambridge.
1915 ... KOTZÉ, Johannes J., B.A. (Cape), Forestry Student, University Union, Edinburgh.
1913 ... *LAING, William, Timber Merchant, Burntack, Dunphail.
1919 ... LAMB, James Allan, Forestry Student, Birnam.
1918 ... *LAWSON, Major Alexander, Annfield, Kingskettle, Fife.
1917 ... LEITCH, Renwick Hutson, M.A., B.Sc., Agricultural College, Glasgow.
1918 ... *LEVEN AND MELVILLE, The Earl of, Glenferness House, Nairn.
1918 ... LEVERHULME, Lord, Lewis Castle, Stornoway.
1918 ... LINDSAY, Major The Earl of, Kilconquhar, Fife.
1918 ... LOCKHART, Col. Sir Simon Macdonald, of The Lee, Lanark.
1916 ... *LODER, Gerald W. E., of Wakehurst Place, Ardingly, Sussex.
1918 ... LOGAN, James, Estate Factor, Coltness, Wishaw.
1915 ... *LONG, Archibald Percy, B.A., Board of Agriculture, 4 Whitehall Place, S.W.
1918 ... *LONSDALE, Earl of, Lowther Penrith, Cumberland.
1918 ... *LORIMER, Henry Dube, of Callands, West Linton.
1918 ... LOW, Sir James, Bart., Kilmaron Castle, Cupar.
1918 ... LUBBOCK, Major Geoffrey, Glenconner, North Berwick.
1918 ... *LUMSDEN, Capt. Hugh P., of Auchindoir, Lickleyhead Castle, Insch, Aberdeenshire.
1918 ... LYON, John Stewart, Kirkmichael, Dumfries.
1918 ... LYON, William, Wood Merchant, Bervie.
1916 ... *M'AINSH, Thomas, Timber Merchant, Crieff.
1918 ... MACALISTER, Major Charles Brodie, Glenbarr Abbey, Argyll.
1918 ... MACAULAY, Alfred Newton, Solicitor and Factor, Golspie.
1919 ... M'CALLUM, Alex., M.A., LL.B., College of Agriculture, 13 George Square, Edinburgh.
1917 ... M'CALLUM, Ian, Assistant Forester, The Lodge, Douglas Pier, Lochgoilhead.
1918 ... *M'CONNEL, James Irving, of Eliock, Sanquhar.
1918 ... *M'CONNELL, John Wanklyn, J.P., of Knockdelian, Colmonell, Ayrshire.
1918 ... *M'COSH, Andrew Kirkwood, of Cairnbill, Airdrie.
1918 ... *M'CRAE, Alex., Timber Merchant, 48 West Regent Street, Glasgow.
1918 ... *M'CRAE, James Tait, Timber Merchant, 48 Regent Street, Glasgow.
1917 ... MACCULLOCH, Andrew, Chartered Secretary, F.C.I.S., 11 West Regent Street, Glasgow.

Date of Election.		
1918	...	MACDONALD, Alexander Hugh, Schoolhouse, Kinlochleven, Argyll.
1916	...	MACDONALD Alfred, Timber Broker, 118 Queen Street, Glasgow.
1918	...	*MACDONALD, A. J., Factor, Rossie Priory, Inchture.
1915	...	MACDONALD, John, Timber Merchant, 3 Union Street, Inverness.
1915	...	MACDONALD, John M., jun., Wood Merchant, 3 Union Street, Inverness.
1917	...	M'DOUELL, Donald Cameron, Estate Overseer, Redeastle, Killearnan.
1918	...	*M'EACHARN, Capt. Neil Boyd Watson, Galloway House, Garlieston.
1917	...	MACFARLANE, Lewis, Factor, Invermay, Douglas Pier, Greenock.
1916	...	MACGILL, Harry C., Forestry Agent (Dip. F., Oxon.), Bishop's Lodge, Rothesay.
1918	...	M'GILL, James Murdoch, M.A., M.B.C.M., Coylbank, Tarbolton, Ayrshire.
1915	...	M'GRAN, James, Gardener, etc., Coodham Gardens, Kilmarnock.
1918	...	MACGREGOR, James, Head Forester, Glenside Cottage, Maybole.
1918	...	*M'INNES, Robert Gemmell, Timber Merchant, 163 Hope Street, Glasgow.
1918	...	*M'INTOSH, Alfred, Shipowner, 5 Clarendon Crescent, Edinburgh.
1917	...	M'INTYRE, Archibald, Timber Merchant, Glenlee, Cardross.
1916	...	MACKAY, Alexander, C.A., Rock Knowe, Broughty Ferry.
1915	...	MACKAY, Duncan, Forester, Toward, Argyllshire.
1918	...	M'KAY, John Brown, Ashbrook, Galashiels.
1914	...	MACKAY, John H., Timber Merchant, Earlston.
1918	...	MACKAY, William, F.R.S.G.S., Tourist Agent, 33 Hanover Street, Edinburgh.
1918	...	MACKEGGIE, J. A., C.A., 75 Bothwell Street, Glasgow.
1918	...	*MACKENZIE, Alexander, Hothouse Builder, 19 Greenhill Gardens, Edinburgh.
1917	...	MACKENZIE, Duncan, Staff Paymaster, R.N.R. (retired), Afton Busby, Lanarkshire.
1918	...	MACKENZIE, Col. Edward Philippe, of Auchenskeoch, Dalbeattie.
1918	...	*MACKIE, Peter Jeffrey, J.P., F.S.H., of Glenreasdell, Whitehouse, Argyll.
1916	...	MACKILLOP, Edward Laurence, Solicitor, 208 St Vincent Street, Glasgow.
1917	...	MACKILLOP, Frederick Gordon, M.A., LL.B., Clydesdale Bank, Johnstone.
1918	...	MACKILLOP, James, Factor, Hoddam Estate Office, Ecclefechan.
1915	...	M'KINNON, John, Gardener, Haddo House, Aberdeenshire.
1918	...	M'LAUCHLAN, James, Timber Merchant, Firhill Sawmills, Glasgow.
1915	...	MACLAY, Sir Joseph Paton, Duchal, Kilmalcolm.
1916	...	*MACLEAN, Alexander John Hew, of Ardgour, J.P., Argyll.
1916	...	MACLEAN, Miss Catherine Helen Dalrymple, Ardgour, Argyllshire.
1918	...	M'LEAN, Donald, Factor, Drumin, Glenlivet, Banffshire.

Date of Election.

1918 ... MACMILLAN, John D., Margam Park, Port Talbot, Wales.
1918 ... MACMILLAN, Thomas Moffat, Glencresh, Moniaive.
1917 ... M'NAY, Alexander, Belhaven Sawmills, Wishaw.
1917 ... MACPHERSON, Duncan James, Glentruim, Inverness-shire.
1915 ... M'PHERSON, James, Estate Manager, Corriemony, Glen Urquhart, Inverness.
1918 ... M'PHERSON, William, Joiner and Building Contractor, Helmsdale, Sutherland.
1919 ... MACPHERSON, William C., Blairgowrie House, Blairgowrie.
1919 ... MACRAE, Donald J., Forestry Student, Birnam.
1918 ... MAITLAND, Viscount, Thirlestane Castle, Lauder.
1918 ... MAKDOUGALL, Hugh James Elibank Scott, Makerstoun House, Kelso.
1918 ... MALLOCH, Miss Beatrice B. M., 13 Parkgrove Terrace, Glasgow, W.
1919 ... MARSHALL, David, W.S., 16 St Andrew Square, Edinburgh.
1915 ... *Marshall, James, Foreman Forester, Lagoonlaw, Novar, Ross-shire.*
1918 ... *MARSHALL, James M'Lean, Bleaton Hallet, Blairgowrie.
1918 ... MARSHALL, William Hunter, of Callander, 25 Heriot Row, Edinburgh.
1918 ... MARTIN, Bernard Davis, 19 West Mayfield, Edinburgh.
1919 ... MARTIN, George, Forestry Student, Birnam.
1918 ... MASON, William, Estate Factor, Strone Cottage, Cairndow, by Inveraray.
1918 ... *MATHESON, Sir Kenneth, Bart., of Lochalsh, 19 Sussex Square, Brighton.
1916 ... MAWSON, Thomas Hayton, Hon. A.R.I.B.A., High Street House, Lancaster.
1918 ... *MELDRUM, Arthur James, Dechmont House, Uphall.
1917 ... *MENMUIR, William Henry, Surgeon Dentist, 3 Lynedoch Place, Edinburgh.
1915 .... MENZIES, George Denholm, Estate Clerk, Penicuik Estate Office, Penicuik.
1918 ... MIDDLETON, Alexander Addison, Bank Accountant, F.S.A.A., North of Scotland, Town & County Bank, Edinburgh.
1919 ... MILLER, Hew, Factor, Corriegour, Invergloy, Inverness-shire.
1917 ... MILLIGAN, Peter, jun., Colliery Manager, Newbyres, House, Gorebridge.
1918 ... *MITCHELL, Alexander Ian, Carolside, Earlston.
1918 ... MITCHELL, James Wilson Rollo, Solicitor, 42 George Street, Perth.
1916 ... MITCHELL, William, Head Forester, Gullyhill, Lanfine, Newmilns.
1918 ... MONCREIFF, Lieut. Henry Wellwood, 6 Ainslie Place, Edinburgh.
1918 ... MONCUR, James Lawrence, Hothouse Builder, 16 Greenhill Terrace, Edinburgh.
1918 ... MONTGOMERY, Sir Basil Graham, Bart., Kinross House, Kinross.
1918 ... MORAY, Capt. W. A. S. Home Drummond, of Abercairney, Crieff.
1918 ... MORRISON, Alexander, Foreman Forester, Dollardstown Nursery, Mageneny, Co. Carlow.

Date of Election.

1916 ... Morrison, Captain J. A., Agent, Basildon Park, Reading.
1916 ... Morton, William Robertson, Estate Office, Dormont Grange, Lockerbie.
1918 ... Muir, George, Forester, Clonad, Tullamore, King's Co.
1917 ... Munro, Captain John Culcairn, J.P., of Marchbank, Balerno.
1918 ... Murdoch, Samuel Fox, Head Forester, Hendersyde Park, Kelso.
1918 .. Murdoch, William, Banker, Logie-Mar, Banchory.
1918 ... *Murray, John, Timber Merchant, 30 Calder Street, Coatbridge.
1917 ... *Murray, Peter, Victoria Sawmills, Coatbridge.
1916 ... M'Vinnie, Samuel, Head Forester, Muirhouse, Falkirk.
1918 ... Nasymth, Thomas Goodall, M.B., B.Sc., F.R.C.S.E. and F.R.C.P.E., 27 Palmerston Place, Edinburgh.
1918 ... Neilson, John, of Mallance, Castle Douglas.
1918 ... Neilson, Walter, Lairdmannoch Lodge, Twynholm.
1918 ... *Nelson, Mrs Margaret, Achnacloich, Connel, Argyll.
1918 ... *Newlands, Lord, Mauldslie Castle, Carluke.
1916 ... Nicolson, Arthur Badenoch, of Glenbervie, Fordoun.
1918 ... Nimmo, Adam, Chairman, Edinburgh Collieries Co., Ltd., Wallyford, Musselburgh.
1918 ... *Noble, John Henry Brunel, M.A., Oxford, Barrister at Law, Ardkinglas, Inveraray.
1918 ... Noble, Robert, of Borthwickbrae, Hawick.
1918 ... Noble, Thomas, Factor, Breadalbane Estates, Kenmore, Aberfeldy.
1919 ... Ogilvie, John Rhind, The Moat, Roslin.
1918 ... *Oliver, Frederick Scott, of Edgerston, Jedburgh.
1918 ... *Park, Alexander, Estate Factor, 175 Hope Street, Glasgow.
1918 .... Park, Hope, S.S.C., 66 George Street, Edinburgh.
1917 ... Parker, James A., B.Sc., M.I.C.E., 80 Guild Street, Aberdeen.
1916 ... Paterson, Charles James George, C.A., 24 St Andrew Square, Edinburgh.
1916 ... Paterson, David, Estate Factor, Lamrick Castle Estates Office, Donne.
1918 ... *Paterson, Robert Cassels, Timber Merchant, 68 Tennant Street, St Rollox, Glasgow.
1918 ... Paterson, Robert, Wood Merchant, Lendrum, Auchterless.
1918 ... Paterson, Rev. Thomas Makdougall Brisbane, Laighstone Hall, Hamilton.
1915 ... Patience, William, Gardener, Bamff House, Alyth.
1918 ... *Paton, Edward Richmond, B.A., F.Z.S., Hareshawinnie, by Kilmarnock.
1917 ... *Paton, George W., Managing Director, Bryant & May, Ltd., Fairfield Works, Bow, London, E.
1916 ... Patterson, John Turner, Marlefield, Helensburgh.
1918 ... Pettitt, Miss Madeline Sara, Craigside, Station Road, Steelford, Birmingham.
1916 ... Philip, William, Gardener and Forester, Avochie, Huntly.
1918 ... Pickering, Robert Young, of Conheath, Conheath, Dumfriesshire.
1918 ... Pilkington, Alan Douglas, M.A., Sandside, Thurso.

Date of Election.

1918 ... PIRIE, William G., Factor, Estate Office, Dalhousie, Bonnyrigg.
1917 ... PLEVINS, Wilfred Maurice, J.P. for Northamptonshire, Woodford House, near Thrapston.
1918 ... *POLWARTH, Walter George Hepburne Scott. Master of, Factor for Lord Polwarth, Humbie House, Humbie.
1918 ... *PORTLAND, The Duke of, K.G., Welbeck Abbey, Worksop.
1916 ... PREDDY, Chas. A., Farmer, Arbuthnot, Fordoun.
1918 ... PRENTICE, Andrew, Head Forester, Birkhill, Clackmannan.
1916 ... PRENTICE, Alexander Reid, Solicitor, 28 Newark Street, Greenock.
1918 ... PRINGLE-PATTISON, Prof. Andrew Seth, LL.D., D.C.L., The Haining, Selkirk.
1916 ... PROFEIT, William James, M.A., B.Sc.(Agr.), Marischal College, Aberdeen.
1918 ... *PULLAR, Edmund, Westerton House, Bridge of Allan.
1918 ... RAE, John, Assistant Forester, Elliock Sawmill, Sanquhar.
1918 ... *RANKIN, Major William Black, of Cleddans, by Airdrie.
1918 ... RATTRAY, John, Estate Clerk, Ninewar, Prestonkirk.
1918 ... *REID, Andrew Thomson, D.L., J.P., of Auchterarder, Auchterarder House, Perthshire.
1917 ... *REID, John, J.P., Engineer, Ardencraig, Rothesay.
1918 ... *REID, Walter Alexander, C.A., Woodbank, Aberdeen.
1915 ... REID, William, Seedsman, 8 Hadden Street, Aberdeen.
1917 ... RICE, Mrs Gerald Spring, of Gowbarrow Old Hall, Penrith, Cumberland.
1918 ... *RICHARDSON, Henry Edward, Broadshaw, West Calder.
1918 ... ROBERTS, Allan, Gardener, Dalton, Lockerbie.
1918 ... *ROBERTS, Sir James, Bart., Strathallan Castle, Machany.
1916 ... *ROBERTSON, Alexander, Commercial Traveller, 125 Willowbrae Road, Edinburgh.
1918 ... ROBERTSON, James, Land Agent, Morebattle, Tofts, Kelso.
1918 ... *ROBERTSON, Robert Drysdale, B.Sc. (Forestry, Edin.), Assistant Conservator of Forests, Nigeria, 14 Derby Street, Leith.
1918 ... ROBERTSON, William, M.A., Classical Teacher, Glasgow Academy.
1915 ... ROBSON, Robert M'Kinnon, Nursery Foreman, 46 Belgrove Terrace, Aberdeen.
1918 ... ROSS, Major David, Factor, 63 Church Street, Inverness.
1916 ... ROSS, Dugald M., Forester, Home Farm, Dunphail, Morayshire.
1915 ... *Ross, Finlay J.*,
1918 ... ROSS, John Gray, Forester, Craibstone, Bucksburn.
1919 ... Ross, Robert, Forestry Student, Birnam.
1918 ... ROSS, William, Assistant Forester, Knockomie Lodge, near Forres.
1916 ... ROURKE, James, Assistant Superintendent of Parks, City Chambers, Glasgow.
1918 ... ROXBURGH, James C., Timber Merchant, 23 Kelvinside Terrace, South Glasgow.
1918 ... ROY, James, Forester, North Lodge, Clerkington, Haddington.

Date of Election.

1918 ... RUSSELL, George Alexander, Factor, Glendouglas, Jedburgh.
1918 ... *RUST, John, Timber Merchant, Aberdeen.
1918 ... SABHARWAL, Lakhpat Rae, B.Sc. (Forestry), 21 Cromwell Road, S. Kensington, London.
1919 ... SALTOUN, Brig.-Gen. The Lord, C.M.G., Philorth, Fraserburgh.
1918 ... *SANDERS, Mrs Madge Fiddes, Rosebank, Lockerbie.
1918 ... SCOTT, James, Forester, Osenam Sawmills, Jedburgh.
1918 ... SCOTT, Montagu-Douglas-, C. W., Sub-Factor for the Duke of Buccleuch, Carterhaugh, Selkirk.
1917 ... SCOTT, William Simson, Sawmiller, 49 Ladyland Road, Maybole.
1918 ... *SELLAR, Gerard Craig, of Ardtornish, Morvern, Argyll.
1918 ... SHANKS, James, Estates Factor, Garscube Estates Office, Bearsden.
1917 ... *SHAW, Sir Arch. M'Innes, V.D., D.L., LL.D., Duvard, Dowanhill, Glasgow.
1915 ... SHIELD, George Rodger, Sub-Factor, Estate Office, Newtyle, Forfarshire.
1918 ... SIMPSON, Charles, Gardener and Head Forester, East Wemyss.
1918 ... SIMPSON, John James, Factor, Dupplin Cottage, Perth.
1918 ... SINCLAIR, Miss Annette Mitchell . 56 Sardinia Terrace, Hillhead Glasgow, W.
1918 ... *SLATER, Andrew, jun., Land Agent, Orchard House, Dovenby, Cockermouth.
1917 ... SMAIL, James, Estate Overseer, Riddell, Lilliesleaf, Roxburghshire.
1916 ... SMITH, Allan, Forester, Dunira, Comrie.
1918 ... SMITH, Andrew, Factor, Invercauld, Ballater.
1918 ... SMITH, David, Timber Manager, 17 Mount Vernon Avenue, Coatbridge.
1918 ... *SMITH, Thomas, F.S.I., Factor, The Castle, Maybole.
1917 ... *SMITH, William Wright, M.A., F.R.S.E., 8 Dudley Terrace, Leith.
1918 ... SMITH, Wm. Alex., 2 West Regent Street, Glasgow.
1918 ... *SOMERVAIL, James Alexander, Hoselaw, Kelso.
1918 ... *SPEEDIE, Alexander, Kinshaldy, Leuchars.
1918 ... *SPEID, James, of Forneth, J.P., Forneth House, Dunkeld.
1918 ... *SPIERS, J. S., Assistant Timber Merchant, Edinburgh.
1919 ... STARK, James, Forester, Glenogil, Kirriemuir.
1916 ... STEEDMAN, John William Elder, S.S.C. and Estate Agent, Royal Bank Buildings, Oban.
1919 ... *STEEL, Major Samuel Strang, M.P., of Philiphaugh, Selkirk.
1918 ... STEUART, Douglas Archibald Seton, of Touch, Cambusbarron, Stirling.
1919 ... *STEVEN, Henry Marshall, B.Sc., Carnegie Research Fellow, Main Street, Broxburn.
1918 ... STEVENSON, Robert Montgomery, Ingliston, Ratho Station.
1917 ... *STEVENSON, Sir Daniel Macaulay, Bart., 12 Waterloo Street, Glasgow.
1918 ... STEWART, Capt. Edward Orde, B.A., M.A.Oxon, Ardwell, Wigtownshire.
1916 ... STEWART, Robert, Horticultural Builder, etc., Broughty Ferry.

Date of Election.

1917 ... *Stirling, Charles, of Gargunnock, Stirlingshire.
1916 ... *Stirrat, William Blair, Westmarch, Kilmalcolm.
1918 ... Storie, Archibald John Watt, Advocate, 9 Golden Square, Aberdeen.
1918 ... *Stodart, David, Farmer, Bughtknowe, Humbie.
1917 ... Storrar, John Ireland, Chamberlain, Hamilton Estate, Hamilton.
1918 ... *Strachan, Alexander Duff, Timber Merchant, Forfar.
1918 ... *Strachan, James Dargie, Timber Merchant, Forfar.
1918 ... *Strathcona and Mount Royal, The Right Hon. The Lady, 46 Green Street, Park Lane, London.
1917 ... *Strathern, Mrs Margaret, Hensingham Road, Whitehaven.
1918 ... Strathern, Robert, W.S., 12 Charlotte Street, Edinburgh.
1918 ... Strutt, George Herbert, Belper, near Derby, and Kinganloch, Ayrshire.
1918 ... Sutherland, George, Assistant Forester, Review Park, Dunrobin, Golspie.
1917 ... Sutherland, Mary, B.Sc. (Forestry), Ry School of Forestry, Parkend, Lydney, Glos.
1918 ... Swindell, Lawrence Evers-, St Wilfrids, East Grinstead, Sussex.
1916 ... Swinton, Captain George, of Gattonside, Melrose.
1918 ... Talbot, Bertram, Monteviot, Ancrum, Roxburghshire.
1918 ... *Tansley, Arthur George, F.R.S., Grantchester, near Cambridge.
1919 ... Taylor, David Stuart, Asst. Chamberlain, Chamberlain's Office, Inveraray.
1918 ... Taylor, Luke, Overseer, Alloa Park, Alloa.
1914 ... Taylor, Robert Johnston, Forester, Harwood, Bonchester Bridge, Hawick.
1918 ... Telfer, William, Head Forester, Neidpath Castle, Peebles.
1918 ... *Templeton, James, 2 Claremont Terrace, Glasgow, and Holme Hill, Dunblane.
1915 ... Thomson, John, Overseer, Thurston Mains Farm, Innerwick.
1916 ... Thomson, John Maitland, of Whim, Lamancha, Peeblesshire.
1918 ... *Thomson, Sir Mitchell Mitchell-, Bart., of Inglismaldie, Laurencekirk.
1916 ... *Thomson, Sir William Rowan, Engineer, Elliot Street, Glasgow.
1918 ... *Tod, William, Engineer, 15 Kirklie Road, Glasgow.
1918 ... Tough, Frank J. M., Assistant Forester, Cothall, Altyre.
1915 ... Townshend, Captain W. Tower, of Myross Wood, Leap, Co. Cork.
1918 ... Tullis, Robert, Paper-maker, Strathenery, Leslie.
1915 ... Tweedie, Fred C., P.A.S.I., 6 Grafton Street, Bolton.
1918 ... Udny, John U., Udny Castle, Aberdeenshire.
1918 ... Waddell, John, Forester, Bellshill, Foswell, Auchterarder.
1919 ... Walker, John, Forestry Student, Birnam.
1918 ... *Wallace, Alexander, W.S., 1 North Charlotte Street, Edinburgh.
1918 ... *Wallace, Falconer L., of Balcairn and Yr. of Candacraig, 40 Brook Street, Grosvenor Square, London.

Date of Election.

1918 ... *Wallace, Prof. Robert, Agricultural Department, University, Edinburgh.
1915 ... Ward, James, Forester, Seafield Estates, Keith.
1915 ... *Wark, Osborne,*
1916 ... *Watson. John P., W.S., 32 Charlotte Square, Edinburgh.
1919 ... Watson, Robert, B.L., 24 Midmar Gardens, Edinburgh.
1918 ... *Watson, William Elder, O.B.E., J.P., Moray Bank, Elgin.
1919 ... Watt, Alexander S., Hotel Proprietor, Whiting Bay Hotel, Arran.
1918 ... *Watts, Francis, Assistant Inspector, Timber Supply Dept., Marion Villa, Inveresk, Musselburgh.
1918 ... Wedderburn, Joseph Robert Maclagen, W.S., 3 Glencairn Crescent, Edinburgh.
1918 ... Weir, Miss Cecilia Mary, 190 Nithsdale Road, Glasgow.
1916 ... *Weir, James, Engineer, Over Courance, by Lockerbie.
1917 ... *Weir, William Goold, Engineer, 190 Nithsdale Road, Glasgow.
1914 ... Whippey, Alan Cecil, Assistant Forester, 11 Lindfield Road, Ealing, W.
1918 ... *Whitelaw, Alexander, of Gartshore, Kirkintilloch.
1918 ... *Whitelaw, William, Chairman, N.B. Railway, Linburn, Kirknewton.
1917 ... Whyte, W. E., Clerk to Middle Ward District, District Office, Hamilton.
1918 ... Whytock, James, Dalkeith House Gardens, Dalkeith.
1918 ... Wight, James, Farmer, Greenwood, Grantshouse.
1917 ... Williamson, John Mentiply, Forester, Glen Cottage, Coltness, Wishaw.
1918 ... *Williamson, Sir Archibald, Bart., M.P., 36 Belgrave Square, London, S.W.1.
1917 ... Willison, Henry Charles, c/o Mrs Fisher, 7 Warman's Cottages, Mill Hill, London, N.W.
1915 ... Wilson, James, Assistant Forester, Wester Fordell, Glenfarg, Perthshire.
1915 ... Wilson, Dr Malcolm, D.Sc., F.L.S., Lecturer on Mycology, Edinburgh University, 31 Wardie Road, Trinity.
1918 ... *Wilson, Miss Mary Georgina Wade, South Bantaskine, Falkirk.
1916 ... Wilson, Robert Hamilton, Head Forester, Pentre Llinigr, Ffynnongroew Mostyn, near Chester.
1918 ... Wilson, Thomas Christie, Factor, Dysart Estate Office, Dysart.
1917 ... Wilson, Thomas Mackay, Factor, Banker and Solicitor, Kirriemuir.
1918 ... Wilson, William, Colliery Manager, Bathville Cottage, Armadale.
1916 ... *Wilson, William, Factor, Castlemains, Douglas.
1919 ... Wilson, Rev. William James, Inchrye, Newburgh, Fife.
1918 ... Wylie, Robert, Solicitor and Bank Agent, 56 John Finnie Street, Kilmarnock.
1918 ... *Wolfe, Robert, The Elms, Bathgate.
1918 ... Wood, E. B., F.R.H.S., 12 Melbourne Place, George IV. Bridge, Edinburgh.
1919 ... Wood, Sir Lindsay, Bart., The Hermitage, Chester-le-Street.

Date of Election.

1918 ... WOODMAN-SMITH, Major John, of Laithers, Turriff, Aberdeenshire.
1918 ... WRIGHT, Andrew Cairns, Timber Merchant, Dunblane.
1918 ... WRIGHT, Oswald Walker, B.A., Airlie Estate Office, Cortachy, Kirriemuir.
1917 ... *YOUNG, Charles, Nurseryman, Kennishead, near Glasgow.
1918 .. YOUNG, James Forsythe, Mouswald Schoolhouse, Ruthwell, S.O.
1916 ... YOUNG, James H., Timber Merchant, Ecclestown, Paisley.
1917 ... *YOUNG, Major John Graham, B.Sc., 231 Elliot Street, Glasgow.
1915 ... YOUNG, John M'D., Lecturer in Botany, West of Scotland College, Glasgow.
1918 ... YOUNGER, Sir William, of Auchen Castle, Moffat.
1918 ... *YOUNGER, William, of Ravenswood, Melrose.
1918 ... *YELLOWLEES, Alfred George, Timber Merchant, Whinfield, Selkirk.

M'Farlane & Erskine, Printers, Edinburgh.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON:

HIS MOST GRACIOUS MAJESTY THE KING.

PROCEEDINGS IN 1918.—*Continued.*

THE GENERAL MEETING.

The General Meeting of the Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Wednesday, 3rd July, at 2.30 P.M. There were 50 members present, and the DUKE OF BUCCLEUCH, President of the Society, presided at the meeting.

APOLOGIES.

Apologies for absence were intimated from Sir John Stirling-Maxwell, Sir Andrew Agnew, Messrs Irvine, Milne-Home, Annand, Leslie, Fraser (Members of Council), and Messrs Alexander, J. C. Calder, A. J. Mitchell, John MacKerchar, C. W. Ralston, C. Augustus Carlow, and A. Slater.

MINUTES.

The Minutes of the Annual Meeting, held in Edinburgh on 20th February last, and of the Special Meeting held on 15th March, were held as read and adopted.

REPORT OF JUDGES.

The SECRETARY explained that the two Essays received had been delayed in passing through the post, and that the recommendations of the Judges had not yet been received. It was agreed that the matter be remitted to the Council with powers.

Development of Afforestation.

The following Resolution was proposed by Mr Richardson and seconded by Mr Allan :—

"This General Meeting of the Royal Scottish Arboricultural Society welcomes the announcement that a Committee of the Cabinet has the question of Forestry Administration under consideration.

"The Meeting desires to impress on Lord Curzon and Mr Barnes the paramount necessity (1) of placing the Central Control of Forest Policy under men conversant with the subject; (2) of freeing the local administration in Scotland from the subservience to agriculture under which it has hitherto laboured; and (3) of making immediate progress with the replanting of cleared areas and the planting of large additional areas, so that public opinion may be satisfied that steps are being taken to protect the country from the grave national danger of a timber famine in the future.

"The Meeting respectfully repeats to the Government a request made to the Minister of Reconstruction that this Society should have an opportunity of considering and expressing its views upon schemes in contemplation before they are actually adopted."

Mr Menmuir moved as an amendment that instead of No. 1, in the second paragraph, the following should be inserted: "of placing the Central Control of forest policy in Scotland under men conversant with the science and art of forestry." Mr Drennan seconded.

Mr E. P. Stebbing referred to American and Indian conditions, where he said the Minister of Agriculture had charge of both agriculture and forestry.

The President pointed out that there was no antagonism between agriculture and forestry, but that on the contrary they were helpful to each other. He also referred to the financial side of the forestry question as affecting private planters, and invited members to read and consider his article on "Taxation of Woodlands," which would appear in next issue of the *Transactions*.

There being no other members expressing a desire to speak,

the PRESIDENT took a vote upon the amendment, for which only 4 voted, and it was declared defeated. The PRESIDENT then submitted the Resolution to the meeting, when 45 members voted for it and 3 members against. It was accordingly declared carried.

It was agreed that the Resolution should be sent to the Sub-Committee of the Cabinet (Lord Curzon and Mr Barnes), the Prime Minister, the Minister of Reconstruction, the Development Commissioners, the Board of Agriculture, and all the Scottish Members of Parliament.

FORESTRY EDUCATION.

A Report of the Education Committee of the Council was then read, and after discussion was remitted to the Council for further consideration.

(A detailed report of the proceedings at the meeting will be found in the *Transactions*, p. 1 of Vol. xxxiii.)

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON:

HIS MOST GRACIOUS MAJESTY THE KING

PROCEEDINGS IN 1919.

THE ANNUAL MEETING.

The Sixty-sixth Annual Business Meeting of the Royal Scottish Arboricultural Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Saturday, 8th February, 1919. His Grace the Duke of Buccleuch, K.T., President of the Society, presided, and there was a large attendance of members. On the invitation of the Council of the Society, representatives of the Board of Agriculture for Scotland and of the Interim Forest Authority were present.

Minutes.

The Minutes of the General Meeting, held in Edinburgh on 3rd July last, were held as read and adopted.

Apologies.

Apologies for absence were intimated from the following:—His Grace the Duke of Atholl; Right Hon. Robert Munro, K.C., Secretary for Scotland; Sir Kenneth Mackenzie, Bart. of Gairloch; General Stirling of Keir; Mr Alex. F. Irvine of Drum; Messrs Robert Allan, J. F. Annand, William Davidson, J. A. Duthie, G. U. Macdonald, Lieut.-Col. Forbes of Rothiemay, Sir Arthur Mackenzie of Coul, Mr H. J. Elwes of Colesborne, and Messrs A. J. Mitchell, John M'Kerchar, and J. Alexander.

Report by the Council for 1918.

The Report of the Council was read as follows:—

Roll of Honour.

The seventh list of names appeared in the July *Transactions* and the eighth list will be included in the part which will be issued in the course of this month. These two lists contain 12 names, and the total names on the Roll is now 271. The Council regret to announce that the following have either been killed in action or have died while serving during the past year, namely:—Mr James Park, Mr Ian D. Macpherson, Mr James Macgregor, Mr James Moultrie, Mr Jacques Rollin, The Earl of Rosse, and Col. D. W. Milne-Home.

Membership.

The total on the Roll of members at the close of last year was 1373. In the course of the year 329 new members have been elected. The following, in addition to those mentioned above, have been removed by death:—John Black, William Morrison, Charles Phillips, Rt. Hon. Dr Farquharson, Alex. Mackenzie, William Wilson, Peter Loney, J. G. A. Baird, Robert Park, James Edgar, Lord Stratheden and Campbell, John Maclaren, Dr Johan Coaz, Alex. Dewar, and John Phillips. In addition to these, 25 names have been removed from the Roll owing to lapsing or other causes. The total membership at the date of the Report is 1655, being 282 more than last year.

Mr John Maclaren, to whom reference was made, was Secretary and Treasurer of the Society from 1879 to 1887, and during that period he discharged the duties of his office with great ability and efficiency.

Dr Coaz was an Honorary Member of the Society, having been elected in 1914. He was formerly Inspector-General of Forestry in Switzerland, and rendered great assistance to the Society in connection with their excursion to that country in 1913. He died on 19th August, at Coire, at the advanced age of 97.

Appeal for New Members.

A holograph letter by the President, accompanied by a Memorandum giving a short account of the objects and work of the Society, was issued in the autumn of last year and resulted in the addition of about 300 names to the roll of members.

Transactions.

The usual issue of *Transactions* in July was made to all members whose subscriptions for the year were then paid. The January part has been unavoidably delayed to enable the inclusion of several important articles. It is expected that the

part will be ready for issue in the course of this month. It will include amongst other articles a report of the conference with the Interim Forest Authority and a list of members elected since the beginning of the war. Owing to the unexpectedly large increase of members the Council has found it necessary to reprint the *Transactions* for last year, so as to admit of each member receiving the two parts for that year. The Council also determined that members serving with the Forces, either at home or abroad, should receive the *Transactions* free during their absence from civil employment.

Essays.

Two essays were received and reported on by the Judges. Major Leather of Middleton Hall was awarded a bronze medal for his essay on an estate creosoting plant. The other essay was not considered of sufficient merit to obtain an award.

Development of Afforestation.

The following Resolution, which was unanimously passed at last Annual Business Meeting, was sent to Ministers and Government Departments interested in forestry :—

> "That this Meeting of the Royal Scottish Arboricultural Society welcomes the publication of the Report of the Forestry Sub-Committee of the Reconstruction Committee, and urges the Government to adopt the scheme of afforestation recommended in the Report and to bring it into operation without delay."

A doubt was, however, expressed by one or two members as to whether the Resolution was wide enough in its terms to embrace the approval of the proposed Central Forest Authority, and with the view of removing any dubiety on the point it was agreed to call a Special Meeting to deal with the matter. This meeting was held in Edinburgh, on 15th March, and was attended by over 50 members. The following Resolution was then submitted, and was supported by 44 members, only one member supporting the direct negative.

> "That this Meeting of the Royal Scottish Arboricultural Society, specially convened, hereby approves of the recommendations of the Forestry Sub-Committee of the Reconstruction Committee, and particularly of the recommendation that a Central Forest Authority, equipped with funds and powers, be created for Great Britain and Ireland, and urges the Government to carry these recommendations into effect without delay."

This Resolution was also forwarded to Ministers and others, as formerly.

The Minister of Reconstruction having referred in a speech to a scheme of afforestation which had not then been published, the Council asked that they should have an opportunity of expressing their views on the scheme before it was finally put forward for adoption. A reply was received that the Council's representation would have attention.

A representation was made to the Board of Agriculture on the subject of the provision of young plants for afforestation, and some correspondence followed.

It having been ascertained that the question of afforestation was being considered by a Committee of the Cabinet, the following Resolution was unanimously adopted at the General Meeting, which was held in Edinburgh on 3rd July, namely:—

> "This General Meeting of the Royal Scottish Arboricultural Society welcomes the announcement that a Committee of the Cabinet has the question of Forestry Administration under consideration.
>
> "The Meeting desires to impress on Lord Curzon and Mr Barnes the paramount necessity (1) of placing the Central Control of Forest Policy under men conversant with the subject; (2) of freeing the local administration in Scotland from the subservience to agriculture under which it has hitherto laboured; and (3) of making immediate progress with the replanting of cleared areas and the planting of large additional areas, so that public opinion may be satisfied that steps are being taken to protect the country from the grave national danger of a timber famine in the future.
>
> "The Meeting respectfully repeats to the Government a request made to the Minister of Reconstruction that this Society should have an opportunity of considering and expressing its views upon schemes in contemplation before they are actually adopted."

The Government having intimated their adoption of the report of the Forestry Sub-Committee of the Reconstruction Committee, the following Resolution was adopted by the Council and sent to Ministers, the Boards of Agriculture, Development Commission, and all the Scottish Members of Parliament:—

> "The Council of the Royal Scottish Arboricultural Society welcomes the gratifying announcement made by Viscount Peel in the House of Lords on 8th August, in reply to the Earl of Selborne, that the report of the Forestry Sub-Committee of the Reconstruction Committee has been accepted by the Government, and that a Central Authority for Forestry for the United Kingdom would be set up and a policy of planting would be pursued with the least possible delay.

"The Council trusts that the Government's intentions so announced will receive legislative sanction as soon as Parliament re-assembles.

"The Council respectfully repeats to the Government the request that this Society should have an opportunity of considering and expressing its views upon schemes in contemplation for Scotland before they are actually adopted."

On 15th November it was announced that an Interim Forest Authority had been appointed to make preliminary arrangements for developing afforestation in the United Kingdom. The Interim Forest Authority consists of Mr F. D. Acland, M.P., Chairman, Lord Clinton, Major David Davies, Col. W. Steuart Fothringham, Brig.-Gen. Lord Lovat, Mr T. B. Ponsonby, Mr R. L. Robinson, and Mr A. MacCallum Scott, M.P. Soon after their appointment the Authority was kind enough to invite the Council to meet them in Edinburgh, and the meeting was held in 1 Queen Street, on 26th November last, when the following subjects were discussed, namely :—

(1) Likelihood of desire by landowners to replant.
(2) Probable dates of replanting.
(3) Supplies of seeds and seedlings.
(4) Staff available ; foresters, nurserymen, labour for planting. Demobilisation and training.
(5) Problems of afforestation.
(6) Any other matters the Council might wish to discuss.

Under the last heading the Council asked for information as to the nature of the permanent authority to be set up, and suggested that local executives should be constituted without delay and that the Central Authority should keep in touch with these local executives. A full report of this meeting will be found in the new issue of the *Transactions*. The Council subsequently sent a letter of congratulation to the Interim Forest Authority, and indicated their desire to co-operate with them in furthering their objects. A small Committee of the Council has been appointed to deal with any remits that may be made to them by the Authority.

The Council is glad to be able to welcome to the meeting Colonel Sutherland, representing the Board of Agriculture for Scotland, and Colonel Fothringham, representing the Interim Forest Authority, who will address the meeting at a later stage.

The Council desires to invite the attention of members to a Memorandum received from the Interim Forest Authority on the subject of the collection of statistics, which will be published in the forthcoming part of the *Transactions*.

Schemes of Afforestation by the Board of Agriculture.

At last Annual Meeting, Dr Greig referred to a number of schemes that were under the consideration of the Board of Agriculture, but were then not sufficiently advanced to enable him to give fuller particulars regarding them. The Council regrets that though the matter has developed since Dr Greig spoke, not one of the schemes to which he referred appears to have materialised. Some correspondence has taken place between the Council and the Board as regards these schemes, but unfortunately no further particulars have been obtainable from the Board about any of them. In the last reply, which was received on 23rd September, the Board merely referred to their previous reply of 16th June last, in which they said that the planting proposals were being considered by the respective proprietors, and that the Board would be glad to supply the Council with particulars of the Craigmyle scheme if the proprietor had no objection. No further reply has been received. The Council desire to point out that afforestation can never make progress if it is pursued in this leisurely fashion.

Scottish Council of Agriculture.

Mr Allan and the Secretary were the Society's representatives on this Council during the past year. It has been decided, however, not to ask representation on this body in future.

Income Tax on Woodlands.

The Finance Bill of 1918, as introduced into the House of Commons, would have made forestry liable to income tax on double the annual value of the land under Schedule B. The Council appointed a small Committee to look into this matter, but the Chancellor of the Exchequer intimated that woodlands would be excluded from this provision, and as effect was given to this promise in the course of debate, the Committee was able to report that the threatened additional burden as regards income tax had been abandoned. The Council, however, continued the Committee to look further into the question of taxation, as the existing burdens were still very heavy. This question was fully dealt with by the President in a letter addressed by him to the Chancellor of the Exchequer and subsequently printed in the *Transactions*.

Introduction to Forestry for Young People.

Three editions of this small book, numbering 4000 copies were printed. A number of these copies were sold. A copy was also sent to each rural schoolmaster in the country, along with a note indicating that additional copies might be available

for distribution to those who applied for them. A large number of applications were received and the balance of the copies in hand were distributed as equally as possible amongst all applicants.

A new edition of the little book has been issued by the publisher, at his own risk, at the selling price of 1s. 6d., but the Society retains the copyright and also the right to purchase copies at 1s. each. One hundred copies of this new edition were purchased by the Society with the object of meeting the requests from members or others.

An application was received from Mr R. Struthers, formerly of British Columbia, for leave to revise this book and adapt it to Canadian conditions. The Council agreed to this request on condition that the revised MS. should be approved by the Education Committee, and that any profits derived from the sale of the book in Canada should be available for the Red Cross Society of British Columbia. The MS. has been received and is now in the hands of the Hon. Editor for approval.

Education.

The Education report which was submitted to the General Meeting in July last was at that meeting remitted back to the Committee for further consideration. It has been before the Committee on several occasions, and some minor alterations have been made upon it. The Committee is of opinion that the Birnam School should be open to apprentice foresters, including women; also that, except in special circumstances, three years' practical training in forestry is necessary to qualify for a College diploma in forestry; that two of these years should be taken previous to entering the College, and the remaining year before the diploma is granted. With regard to the Aberdeen University and the North of Scotland Agricultural College it was considered that, in view of the close relationship between those two bodies, the diploma in that case might be granted by the University instead of by the College.

The Council is much gratified to be able to report the receipt of a donation of £100, from a friend who desires to remain anonymous, for the extending of interest in forestry among teachers and young people, and to be used for prizes or literature and expended in one or two years. This matter, and a proposal that the Society should establish one or more bursaries, are being carefully considered by the Education Committee.

Presentations.

The Council has pleasure in intimating that portraits of Mr Archibald Menzies and Mr David Douglas have been presented to the Society by Colonel Balfour of Dawyck.

Local Secretaries.

Mr Edward Wiseman, Nurseryman, Elgin, has been good enough to offer his services as Local Secretary for Morayshire, and he will be included amongst the Local Secretaries to be elected in the course of the meeting.

Parliamentary Committee.

A letter was received from the Royal English Arboricultural Society, suggesting that the Members of Parliament who are members of either Society should be asked to form themselves into a Committee to protect the interests of forestry. Before Parliament was dissolved some progress had been made with this movement, and the Council have decided to support it in the new Parliament as far as possible. They are arranging that the President and the Hon. Secretary shall be members of the Committee.

Library.

The usual list of additions to the Library will be appended to the printed report.

Exhibition.

Members have no doubt seen from the notice calling this Meeting, that the Council has decided to resume the annual Exhibitions in the Highland and Agricultural Society's Show, and that the Show is to be held in Edinburgh this summer. The Timber Supply Department of the Board of Trade has been good enough to offer to make available for this Exhibition, specimens of home-grown timbers produced for national purposes during the war, together with photographs of a number of woods from which the timber has been cut. The Council will also welcome offers of timber specimens and other timber products from Timber Merchants, Owners of Woodlands, and other members of the Society.

Dunn Memorial Fund.

No payments have been made during the year, and the amount at the credit of the fund is now £11, 17s. 9d. (See Appendix A.)

Local Branches.

The usual reports have been received from the Aberdeen Branch, and will be appended to this report. (See Appendix C.)

Unfortunately the Northern Branch has been inactive since the lamented death of Colonel Fraser, the Hon. Secretary to the Branch, but it is hoped that the members in the Northern District will soon be able to resume active operations.

On the motion of the PRESIDENT, seconded by Mr JAMES WHITTON, Glasgow, the Report of the Council was unanimously adopted.

ACCOUNTS.

Mr W. H. MASSIE, Edinburgh, in moving the adoption of the Accounts, said:—"The Accounts have been printed (see Appendix B) so it is unnecessary to go into details, but I may say our Society is now in a better position financially and as regards membership than it has ever been in its existence. Our President sent out an appeal for new members, and it had a splendid response bringing in over 300 members. Of that number 98 were life members, which meant an immediate addition to our funds of £773. Our funds now amount to something like £2300. During the past year our income has been altogether £751. That does not take into account, of course, life membership. Our expenditure has been £577, leaving a balance to the good of £174. You will notice also that our investments are going in the right direction. There is an appreciation of £70, so that on the whole we can congratulate ourselves on having had a very good year." The motion was seconded, and unanimously adopted.

ELECTION OF OFFICE-BEARERS.

The following Office-bearers were elected in place of those who retired by rotation:—President—The Duke of Buccleuch was re-elected. Vice-President — James Whitton, Glasgow. Councillors—Wm. Gilchrist, Mount Melville; George Leven, Bowmont Forest; J. F. Annand, Armstrong College; Alexander Finlayson, Newbattle; and A. B. Robertson, The Dean, Kilmarnock.

The Hon. Secretary, the Secretary and Treasurer, the Hon. Editor, the Auditor, and the Hon. Consulting Scientists, were re-elected.

The Local Secretaries were also re-elected, with the addition of Mr Wiseman, Nurseryman, Elgin, for Morayshire. (For a list of the Office-bearers for 1919, see Appendix E).

FORESTRY EXHIBITION.

Sir JOHN STIRLING-MAXWELL, Bart. of Pollok, Honorary Secretary, said:—"I think the suggestion came, as many good

suggestions, from Dr Borthwick that at this coming Exhibition we might try, as far as we can, to make the Show representative of what the woods in Scotland have done during the war, and with that view the Department over which I have at present the honour of presiding in Scotland will do its very best to make its share of the Exhibition representative. I may be allowed to say in that connection that since I have been in that Department —for a year—hardly a day passes that I have not occasion to be grateful to my friend on my right, Colonel Sutherland, for the good foundations which he laid there, and if, as I believe, the exhibition we have at the showyard will be of considerable interest, it must be largely due to those who went before me that it has been possible to bring such things together, and that Scotland has been able to take so considerable a part in finding timber. Perhaps I may mention two things which will interest you and which have struck me. One is that a good many of the most important woods which have been felled by the Government during the war were planted in response to encouragement given by the Highland and Agricultural Society at the beginning of last century. They gave medals to people who laid out plantations, and many of the plantations which earned medals are those which have been most useful in the war. The other thing which struck me was that among the practical foresters in Scotland, who have been of real value to the Government, a very large proportion were trained at the school in the Royal Botanic Garden, showing, again, how encouragement given at a timely moment may produce good results in forestry. Another thing is this, that when we came to make systematic measurements of crops of growing timber in Scotland it became at once apparent that the capability of our soil and climate for growing timber has not been exaggerated but very much under-rated in the past, and I may say the Report of the Reconstruction Committee, so far as it went into figures of production, is not only on the safe side but greatly under-rates the possibilities of silviculture in this country."

Colonel Fothringham of Murthly.—"One suggestion I would like to make in connection with this exhibition. A little departure from the old style of exhibition is, I understand, being arranged by the Royal Agricultural Society in England. They propose to have a demonstration of some of the woodland

industries in the showyard. It is a feature which, I do not think, we have had up till now—such things as cleaving timber for hurdles or handles, the making of barrel binders and staves, and a few of the industries that are still carried on to some extent in the South of England, and which might be profitably carried on in a great many places in England and Scotland. It might be possible to arrange with the people who are to have this demonstration going on at the English Show to give a similar demonstration at the Show in Edinburgh. That, I suppose, will be for our Committee to arrange with the Highland and Agricultural Society."

Sir HUGH SHAW STEWART.—"Space is being allocated, and I think it would be advisable, as soon as we have any idea of what we require, to intimate that to the Secretary of the Highland Society. Might I suggest that the results of the measurements referred to by Sir John Stirling-Maxwell should be published in the *Transactions?*"

Sir JOHN STIRLING-MAXWELL.—"As a matter of fact, I have handed over that part of my work to the new Forestry Authority, but I am sure it is the wish of all concerned that they should be made use of as early as possible."

A MEMBER suggested that there should be an exhibit of young forest trees in the showyard.

The PRESIDENT. — "I am sure we all welcome Colonel Sutherland back. He is an old friend of ours, although he has been more or less away from us for the last year. I am sure we are glad to see him here, and it will be very interesting to hear what he has to say."

Colonel SUTHERLAND, of the Board of Agriculture for Scotland, then addressed the meeting (for a full report of his speech see p. 93 of the July *Transactions*).

Colonel FOTHRINGHAM, of the Interim Forest Authority, was then called on to address the meeting (a full report of his speech is also printed in the July *Transactions*, see p. 98).

The PRESIDENT.—"We are very much obliged to Colonel Sutherland and Colonel Fothringham. I think what they have said rather emphasises the necessity of the resolution which is now to be submitted to the meeting."

Mr George Leven, Bowmont Forest, Kelso, moved the following resolution:—

> "This meeting of the Royal Scottish Arboricultural Society, while cordially welcoming the appointment of the Interim Forest Authority, respectfully urges the Government to pass without delay the necessary legislation, setting up a permanent Forest Authority with Local Executives and endowed with adequate funds and the fullest powers to enable it to carry out effectively a progressive forest policy for the United Kingdom, having regard to the extent of suitable land available in each country as well as to the timber requirements of the whole kingdom."

"I think the resolution requires very few words at this time to commend it to you. The facts as laid before you by Colonel Fothringham are exactly what I would lay before you. The fact that this Interim Authority has so little power to act is really the vital point in the whole motion. The necessity of having a permanent Authority established at once has been stated by Colonel Fothringham. I think we are all at one in that. We have urged this for at least a quarter of a century, probably well on for half a century, but a quarter of a century in my own experience—the setting up of something that would co-ordinate all our efforts. In my humble capacity I have been asked repeatedly by small landed proprietors, 'What are we going to plant? Is there any prospect of this Forest Authority giving us any lead? Are the Government to take any hand with the re-afforestation, or shall we be expected to carry out the whole operations ourselves? What are the prospects as to the supply of seed and plants and labour?' There are a great many things that I feel myself I am unable to answer at this time. Probably ten or twelve years ago I would have attempted to answer a good many of these questions. At the present time when so much has been promised and so little accomplished one has their doubts about giving advice on these points, and I think this is a strong reason why this Authority should be established without the least delay, in order that these people who are anxious to carry out these afforestation problems in the areas that have been cleared should be able to get the advice they want from the recognised authorities

at once. I think I need say nothing further to commend the resolution to you. It is quite apparent, and I think after the two admirable addresses from the gentlemen on the platform to-day that the need for this resolution is really brought to the crucial point."

Mr Robert Forbes, Kennet Estate Office, Alloa.—"I have very much pleasure in seconding the resolution."

The President. — "The motion has been proposed and seconded. Before putting it to the meeting is there anyone who has anything to say on it, or any amendment to move?"

Colonel Martin Martin, Skye.—"There is one question I should like to ask Colonel Sutherland, and that is about the employment of Highlanders returning home now after service abroad. They are coming home and they are wondering whether they should immediately emigrate or whether they should accept the conditions at home, and although there are many reasons for delay, which Colonel Sutherland has stated and which are quite obvious, still in this case there can be no delay. If these men do not get employment they will emigrate, as their brothers and relations have already done. They are considering the terms they can obtain at home and the terms they can obtain in the Colonies and in the States and elsewhere, and as soon as steamers are available to carry them abroad, which will be September, I believe, a great many of them will go and then we shall not have the labour we require for our forestry operations. I think that is a question which cannot be delayed, and whatever Authority is established must consider that question at once, or this summer, as to whether they will be able to retain the population in the Highlands or not. As everybody knows, 40 per cent. of the areas of Scotland is in the Highlands, and there is 6 per cent. of the population in the Highlands. That ought to be remedied, and very largely, through afforestation, but it would be perfectly futile to hope for this unless some attraction is offered to the population. Otherwise they will emigrate. That is what I wish to bring before the meeting, as I have been resident in the Highlands for a great many years—in Skye and the West Highlands, where the conditions are acute but not so acute as in the Outer Islands. It is not a very technical point, but it is a very important and practical point, which I should like the Arboricultural Society to consider because it is urgent."

Mr Leslie, Aberdeen.—"A good many proprietors that I know are taking on batches of seven or eight men at a time and providing bothies, and their intention is eventually to provide houses for these men. I know that movement is on at the present moment. I could name several estates where seven or eight men have been taken on. I know the movement will spread and become very general."

The motion was then unanimously adopted.

Colonel Sutherland.—"It is very difficult for me to answer about a question which I have not had time to study, but I know forestry development cannot possibly very largely begin until the summer sets in, and in the meantime employment so far as it can be got for the worthy men who are returning must be found somewhere else. But I should think by summer, and certainly by autumn, there will be a sufficient development to give employment to a good many men who have come back. There is an interesting side to this question. Colonel Balfour and I have been a good deal together in connection with the Canadian Forestry Corps, and we find there are quite a number of Canadians very unwilling to go back to Canada, and it is just possible that our own men, who have had a good deal of intercourse with the Colonials during the year and the past years, may see that there are disadvantages in the Colonies and may not be altogether so keen to rush away."

The President.—"The point is a very important one and it is a difficult one, and I am glad Colonel Martin has raised it. I am quite certain the Board of Agriculture will do what they can, as far as it is possible, to meet these difficulties, and I am sure the Arboricultural Society will be anxious to support them in every way."

Dr Campbell.—"I beg to move a very cordial and hearty vote of thanks to Colonel Fothringham and Colonel Sutherland for the very admirable addresses they have given here to-day. We are extremely fortunate in having such a gentleman as Colonel Fothringham in connection with this work. There are few men who have the practical experience and knowledge of forestry that Colonel Fothringham has. He has been favoured in being the proprietor of a beautiful district of country growing almost every variety of timber and receiving his personal attention. I think we ought to award to Colonel Fothringham our very special thanks for coming here to-day, not only in his

capacity as a leading member of the Interim Authority, but also on account of his personal qualifications. We are all very glad to see our genial friend Colonel Sutherland among us. We certainly missed him sadly, but the period of service he has spent in France has been turned to good account from what he has stated to you. As you are all aware, we are far behind our neighbours on the Continent in the management of forests, and we hope Colonel Sutherland, as I have said, will give us the benefit of his additional knowledge in the management of affairs in Scotland. I beg to move a vote of thanks to these two gentlemen."

Colonel BALFOUR seconded the vote of thanks. He said, "I think we may congratulate ourselves that Colonel Sutherland will be here in Edinburgh, and that Colonel Fothringham is on the Interim Authority, as we know both these gentlemen are such enthusiastic foresters and take such close interest in all matters to do with forestry. I think Colonel Fothringham kept the kernel of his remarks to the end when he told us that the Bill which is being promoted is in a very forward condition and will be presented to Parliament at an early date. That, I think, is gratifying information to all of us, and we only hope it will be passed through Parliament without any undue delay, so that the permanent Authority will be set up and can take steps towards the engaging of men to be trained as permanent forest officers. Colonel Sutherland is again back with us in Edinburgh, and I am sure the negotiations which he spoke of with proprietors in respect of the acquisition of land for forestry purposes by the permanent Authority could not be in better hands than in his."

The proceedings terminated with a cordial vote of thanks to the President.

APPENDIX A.

ABSTRACT OF ACCOUNTS

IN CONNECTION WITH

THE MALCOLM DUNN MEMORIAL FUND, YEAR 1918.

RECEIPTS.

Balance in Bank at close of last Account . .	£9	0	9
Income Tax recovered	0	15	0
Dividend on £100 Redeemable Stock of Edinburgh Corporation, payable at Whitsunday and Martinmas, 1918, £3, *less* Tax, 18s. .	2	2	0
	£11	17	9

PAYMENTS.

Nil.

Balance carried forward, being sum in National Bank of Scotland on Account Current .	£11	17	9

EDINBURGH, 23*rd January* 1919.—Examined and found correct. The Certificate by the Bank of above balance, and Edinburgh Corporation Stock Certificate, have been exhibited.

ALEX. J. MUNRO,
Auditor.

People, ...				£130	0	0		
Less Received from Publishers for Sales,	£46	0	0					
Payment to Account of Cost in 1917,	60	0	0					
				106	0	0		
				£24	0	0		
Price of 100 copies of New Edition purchased from Publishers, ...				5	0	0		
Circular, ...				0	9	6		
				£29	9	6		
Balance at close of Accounts, . . .				.		.	323	4 6
1. Education Fund—Balance, . .				£116	9	4		
2. Special Report Fund, . . .				100	0	0		
3. Balance of Accumulated Revenue carried to next year, subject to payment of cost, etc., of January *Transactions* . .				106	15	2		
Note.—Balance as above, . .				£323	4	6		
On Deposit Receipt with National Bank of Scotland, Ltd., .	£290	0	0					
At credit of Account current with National Bank of Scotland, Ltd., ...	17	4	10					
In Treasurer's hands, . .	15	19	8					
				£323	4	6		
							£1443	6 10

£1443 6 10

EDINBURGH, 23*rd January* 1919.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1918, of which the above is an Abstract, and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me.

ALEX. J. MUNRO, *Auditor.*

APPENDIX B.

Abstract of Accounts for Year ending 31st December 1918.

I.—CAPITAL.

CHARGE.

1. Funds at 31st December 1917,—		£1146 11 6
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 70¾	£351 7 0	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 75,	375 0 0	
£400 North British Railway Company 3 per cent. Debenture Stock, at 56,	224 0 0	
£400 North British Railway Company, No. 1, 4 per cent Preference Stock, at 72½,	290 0 0	
	£1240 7 0	
Furniture, etc., in Society's Room,	40 0 0	
	£1280 7 0	
Less Balance at Debit of Capital,	133 13 6	
	£1146 11 6	
2. Increase in value of Railway Stocks since 31st December 1917,		69 10 0
Life Members' Subscriptions in 1918,		808 3 0
New Members,	£773 17 6	
Ordinary Members by commutation,	34 6 0	
3. Sum transferred from Revenue,		512 12 7
		£2536 17 1

DISCHARGE.

1. Proportion of Life Members' Subscriptions transferred to Revenue,		£187 2 1
Commuted: £100 less 5 per cent.	£165 5 4	
⅓ of Full Life Subscriptions,	21 16 9	
⅓ of Commuted Subscriptions,		
2. Investments made—		
£200 Regd. 5 per cent. National War Bonds, 1927,	£200 0 0	
£500 " " 1928,	500 0 0	
£300 " " "	300 0 0	
	£1000 0 0	
3. Funds, etc., at 31st December 1918		
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 70¾	£367 10 0	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 79½	398 15 0	
£400 North British Railway Company 3 per cent. Debenture Stock, at 60½	240 10 0	
£400 North British Railway Company, No. 1, 4% Preference Stock, at 75¾	303 0 0	
£1000 Regd. 5% National War Bonds as above,	1000 0 0	
	£2309 15 0	
Furniture, etc., in Society's Room, say,	40 0 0	
	£2349 15 0	
	£2536 17 1	

II.—REVENUE

CHARGE.

1. Balance in hand at 31st December 1917,		£588 3 3
2. Ordinary Members' Subscriptions,		467 18 6
Arrears at 31st December 1917,	£86 12 6	
Add Arrears written off but since recovered,	2 8 0	
	£88 0 6	
Subscriptions for 1918,	£481 8 0	
Less Received in 1917,	4 6 6	
	477 1 6	
Subscriptions for 1919 received in 1918,	15 4 6	
	£580 6 6	
Deduct—		
Cancelled or written off as irrecoverable at 31st December 1918, including sums standing against Members serving with the Colours,	£99 19 0	
Arrears at 31st December 1918,	£13 11 0	
Less received but not appropriated, numbers names being unknown,	1 2 6	
	12 8 6	
	112 7 6	
	£467 18 6	
3. Proportion of Life Members' Subscriptions transferred from Capital,		187 2 1
4. Dividends and Interest,		70 15 0
5. *Transactions* sold, less purchased,		9 3 5
6. Income Tax Recovered,		17 0 0
7. Education Fund,—		
(1) From A Friend—Donation for Special Purpose,	£100 0 0	101 1 3
(2) Sales of *Introduction to Forestry for Young People*,	1 1 3	
8. Sale of Waste Paper,		2 3 4
	£1443 6 10	

DISCHARGE.

1. Printing, Stationery, etc.,		£282 1
Vol. XXXII. Part I. *Trans.*,	£101 7 0	
Vol. XXXII. Part II. *Trans.*,	£77 3 6	
Paper purchased (Part still unused),	48 0 0	
Authors' Reprints,	4 17 0	
	130 0 6	
	£231 7 6	
General Printing, Stationery, Binding, etc.	76 10 10	
Less Receipts for Advts. in *Trans.*	£307 18 4	
	25 10 0	
	£282 8 4	
2. Prizes (Medals)		0 10 0
3. Contribution to Aberdeen Branch,		5 0 0
4. Contribution to Scottish Council of Agriculture,		5 0 0
5. Fees to Reporters,		13 13 6
6. Expenses of Management,—		271 7 11
Rent of Room and Taxes for 1918, and Halls for Meetings,	£25 14 6	
Auditor,	2 2 0	
Hon. Editor's Assistant,	30 0 0	
Secretary and Treasurer,	125 0 0	
Advertising, Insurance, and Premium on Secretary's Bond of Caution,	5 3 11	
Councillors' Luncheons	8 11 0	
Postage and Miscellaneous Outlays, viz.:—		
Postages of Parts I. and II. of Vol XXXII. of *Transactions*, £25 15 11		
General Postages, Commissions on Cheques, and Petty Outlays, 46 18 7		
	72 14 6	
	£271 7 11	
7. Sum transferred to Capital,		512 12 7
8. Education Fund,—		29 9 6
Cost of Printing 3 Editions 4000 copies—of *Introduction to Forestry for Young People*,	£139 0 0	
Less Received from Publishers for Sales, £46 0 0		
Payment to Account of Cost in 1917, 60 0 0		
	106 0 0	
	£33 0 0	
Proceeds three years of New Edition purchased from Publishers,	£21 0 0	
	5 0 0	
Circular	0 9 6	
	£26 9 6	
Balance at close of Accounts,—		334 4 6
1. Education Fund Balance,	£176 9 4	
2. Special Report Fund,	100 0 0	
3. Balance of Accumulated Revenue carried to next year, subject to payment of cost etc., of January *Transactions*	106 15 2	
Note.—Balance as above,	£1323 4 6	
On Deposit Receipt with National Bank of Scotland, Ltd.,	£1300 0 0	
At credit of Account current with National Bank of Scotland, Ltd.,	17 4 10	
In Treasurer's hands,	15 19 8	
	£1333 4 6	
	£1443 6 10	

EDINBURGH, *23rd January* 1919.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1918, of which the above is an Abstract and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me

ALEX. J. MUNRO, *Auditor*.

APPENDIX C.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (ABERDEEN BRANCH).

REPORT 1918.

The Committee beg to submit the Thirteenth Annual Report of the Branch.

The Membership of the Branch is 135, eighteen having joined the Branch.

In view of the continuance of the war, and the restricted travelling facilities, it was decided not to hold any excursions during the year, and, accordingly, only two regular meetings of the Branch have been held, one being the Annual Meeting on 14th December 1917, and the other on 14th September 1918.

At the Annual Meeting, after the formal business had been transacted, the members lunched together in the Douglas Hotel, Aberdeen, and during the afternoon the party visited the timber yard of Messrs George Gordon & Co., Ltd., where a new saw was seen in operation; and also the boxmaking factory of Messrs James Cordiner & Sons, Torry, where they saw many modern appliances at work.

The Meeting held on 14th September 1918, took the form of a visitation to the Burnside Nurseries of Messrs Smith & Sons, and to Pinewood Nurseries of Messrs Ben Reid & Co., both in close proximity to the city of Aberdeen. There was a very large attendance of members, who expressed their astonishment and admiration for the manner in which the nurserymen had been able to keep up their stocks of plants under very great difficulties, and at considerable expense, and they were very highly commended for their patriotic spirit in doing so. At the Pinewood Nurseries a practical demonstration was given of Messrs Ben Reid & Co.'s hinged transplanting boards, a method of transplanting which appears to have aroused considerable attention in forestry circles. The Company was very hospitably received and entertained at both nurseries by the heads of these old firms, and altogether the day was one of the most enjoyable and instructive which has taken place in the annals of the Branch.

The Library Committee regret that more advantage is not being taken of the Branch Library. They wish to thank Mr Peter Leslie, M.A., B.Sc., Lecturer on Forestry at Marischal College, for kindly presenting a volume to the Library.

ALEX. F. IRVINE,
President.

GEORGE D. MASSIE,
Secretary.

ABERDEEN, 6*th December* 1918.

APPENDIX D.—Royal Scottish Arboricultural Society (Aberdeen Branch).

STATEMENT OF ACCOUNTS, Year 1918.

GENERAL ACCOUNT.

INCOME.

	£	s	d
Balance at Credit of last Account	10	2	4½
Subscriptions from Members at 1s.	7	0	0
Savings Bank Interest	0	4	6
Grant from Parent Society	5	0	0
	£22	6	10½

EXPENDITURE.

	£	s	d
Complimentary lunch tickets and tips at General Meeting	1	0	0
Printing, Postages, Commission on Cheque and Incidents	2	0	0½
Secretary's Honorarium for 1917	5	5	0
Transferred to Excursion Account	0	11	1
Transferred to Library Account	1	16	6
Balance at Credit of Account	11	14	3
	£22	6	10½

EXCURSION ACCOUNT.

	£	s	d
Sum transferred from General Account	0	11	1
Balance at Debit of Account	1	19	0
	£2	10	1

	£	s	d
Balance at Debit of last Account	0	11	1
Printing	1	9	0
Postages, etc.	0	10	0
	£2	10	1

LIBRARY ACCOUNT.

	£	s	d
Sums transferred from General Account	1	16	6
	£1	16	6

	£	s	d
Balance at Debit of Account	0	6	6
Postages and Incidents	0	1	0
Balance at Credit of Account	1	9	0
	£1	16	6

ABSTRACT.

	£	s	d
Balance at Credit of General Account	11	14	3
Balance at Credit of Library Account	1	9	0
	£13	3	3
Balance at Debit of Excursion Account	1	19	0
Balance at Credit of Branch per Savings Bank Pass Book No. 393	£11	4	3

Aberdeen, *4th December* 1918.—I have examined the foregoing Statement of Accounts, and have compared same with the vouchers, and find them to be properly stated and vouched, the balance at the credit of the Branch being £11, 4s. 3d., which is deposited with the Aberdeen Savings Bank, per Savings Bank Pass Book, No. 393, which I have also seen.

Wm. WYLLIE.

APPENDIX E.

Office-Bearers for 1919:—

PATRON.

His Majesty The King.

PRESIDENT.

The Duke of Buccleuch, K.T., Dalkeith Palace, Dalkeith.

VICE-PRESIDENTS.

Chas. Buchanan, Factor, Penicuik.
W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.
J. H. Milne Home, Irvine House, Canonbie.
Lord Forteviot, Dupplin Castle, Perth.
James Whitton, Superintendent of City Parks, City Chambers, Glasgow.

COUNCIL.

Hon. Life Members.

Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh
Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

Ordinary Members.

Robert Allan, Factor, Polkemmet, Whitburn.
Brig.-Gen. Archibald Stirling of Keir, Dunblane.
J. A. Duthie, Nurseryman, Aberdeen.
A. MacCallum Scott, M.P., House of Commons, Westminster.
W. S. Curr, Factor, Ninewar, Prestonkirk.
Charles Robertson, Forester, Colstoun, Haddington.
Lieut.-Col. F. R. S. Balfour of Dawyck, Stobo.
Alexander Morgan, Wood Merchant, Crieff.
George Mowat, Forester, Hamilton Estates, Riccarton by Hamilton.
Peter Leslie, B.Sc., Lecturer in Forestry, Marischal College, Aberdeen.
Adam Spiers, Timber Merchant, Warriston Sawmills, Edinburgh.
George U. Macdonald, Woodbine Cottage, Peebles.
Robert Forbes, Kennet Estate Office, Alloa.
George Fraser, Dalzell Estate Office, Motherwell.
Andrew Hamilton, The Bungalow, Hairmyres, East Kilbride.
James Cook, Overseer, Arniston, Gorebridge.
John Broom, Wood Merchant, Bathgate.
William Davidson, Forester, Edgerston, Jedburgh.
James Terris, Barns House, Blairadam, Kelty.
D. K. M'Beath, F.S.I., Fairfield Works, Bow, London, E.3.
William Gilchrist, Forester, etc., Mount Melville, St Andrews.
George Leven, Bowmont Forest, Kelso.
John F. Annand, M.Sc., Lecturer in Forestry, Armstrong College, Newcastle-upon-Tyne.
Alexander Finlayson, Overseer, etc., Newbattle, Dalkeith.
A. B. Robertson, Forester, The Dean, Kilmarnock.

Extra Member—President of Aberdeen Branch (A. F. Irvine, of Drum, Aberdeen).

HON. EDITOR.

Dr A. W. Borthwick, 29 St Andrew Square, Edinburgh.

AUDITOR.

Alex. J. Munro, 48 Castle Street, Edinburgh.

HON. SECRETARY.

Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

SECRETARY AND TREASURER.

Robert Galloway, S.S.C., 8 Rutland Square, Edinburgh.

HONORARY CONSULTING OFFICIALS.

Botanist—Professor Bayley Balfour, Royal Botanic Garden, Edinburgh.

Chemist—Dr Alexander Lauder, F.I.C., 13 George Square, Edinburgh.

Cryptogamist—Dr A. W. Borthwick, 29 St Andrew Square, Edinburgh.

Entomologist—Prof. Stewart MacDougall, 9 Dryden Place, Edinburgh.

Geologist—Dr R. Campbell, Geological Laboratory, University of Edinburgh.

Meteorologist—Andrew Watt, M.A., F.R.S.E., 122 George Street, Edinburgh.

TRUSTEES.

Lieut.-Col. W. Steuart Fothringham of Murthly, Sir John Stirling-Maxwell, Bart. of Pollok, and Sir Andrew N. Agnew, Bart. of Lochnaw, Stranraer.

LOCAL BRANCHES.

Aberdeen.

President.—A. F. Irvine of Drum, Aberdeen.

Hon. Secretary.—George D. Massie, Advocate, 147 Union Street, Aberdeen.

Northern.

President.—

Hon. Secretary.—

CORRESPONDENTS RESIDING ABROAD.

The following are Correspondents residing abroad :—

Canada, . Robert Bell, I.S.O., M.D., LL.D., D.Sc. (Cantab.), F.R.S. of Ottawa. Late Chief Geologist to Government of Canada, Ottawa.

India, . . F. L. C. Cowley Brown, Principal, South Indian Forest College, Coimbatore, South India.

British East Africa, . Edward Battiscombe, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.

United States of America, Hugh P. Baker, Dean, New York State College of Forestry, Syracuse, N.Y.

Cape Colony, . W. Nimmo Brown, M'Kenzie's Farm, Mowbray, P.O.

Western Australia, Fred Moon, Craigian, Bighill Brook, Harren River, Manjimup.

New Zealand . R. G. Robinson, Department of Lands, State Forests Branch, Tapanui, Otago.

South Africa . K. A. Carlson, Orange Free State Conservancy.

PHOTOGRAPHIC ARTIST.

A. D Richardson, 19 Joppa Road, Portobello.

LOCAL SECRETARIES.

Counties.	
	Scotland.
Aberdeen,	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, M.V.O., Factor, Balmoral, Ballater.
Argyll,	H. L. MACDONALD of Dunach, Oban.
Ayr,	ANDREW D. PAGE, Overseer, Culzean Home Farm, Ayr.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Berwick,	
Bute,	WM. INGLIS, Forester, Cladoch, Brodick.
Clackmannan,	ROBERT FORBES, Estate Office, Kennet, Alloa.
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East Lothian,	W. S. CURR, Factor, Ninewar, Prestonkirk.
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Forfar,	
Inverness,	JAMES A. GOSSIP, Nurseryman, Inverness.
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Kinross,	JAMES TERRIS, Barns House, Blairadam, Kelty.
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Perth,	JOHN SCRIMGEOUR, Doune Lodge, Doune.
Ross,	
Roxburgh,	JOHN LEISHMAN, Manager, Cavers Estate, Hawick.
	R. V. MATHER, Nurseryman, Kelso.
Sutherland,	DONALD ROBERTSON, Forester, Dunrobin, Golspie.
Wigtown,	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Monreith Estate Office, Whauphill.
	England.
Beds,	FRANCIS MITCHELL, Forester, Woburn.
Berks,	W. STORIE, Whitway House, Newbury.
Derby,	S. MACBEAN, Estate Office, Needwood Forest, Sudbury.
Devon,	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
Durham,	JOHN F. ANNAND, M.Sc., Lecturer in Forestry, Armstrong College, Newcastle-upon-Tyne.
Hants,	W. R. BROWN, Forester, Park Cottage, Heckfield, Winchfield.
Herts,	THOMAS SMITH, Overseer, Tring Park, Wigginton, Tring.
Kent,	R. W. COWPER, Gortanore, Sittingbourne.
Lancashire,	D. C. HAMILTON, Forester, Knowsley, Prescot.
Leicester,	JAMES MARTIN, The Reservoir, Knipton, Grantham.
Lincoln,	W. B. HAVELOCK, The Nurseries, Brocklesby Park.
Notts,	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Station Road, Tuxford.
Surrey,	JOHN ALEXANDER, 24 Lawn Crescent, Kew Gardens.
Warwick,	A. D. CHRISTIE, Hillside, Castle Road, Warley, Birmingham.

Counties.	
	England.
Wilts, . .	ANDREW BOA, Land Agent, Glenmore, The Avenue, Trowbridge.
York, . .	GEORGE HANNAH, Estate Office, Boynton, Bridlington.
	Ireland.
Dublin, . .	A. C. FORBES, Department of Forestry, Board of Agriculture. ARCH. E. MOERAN, Lissadell, Stillorgan Park.
King's County, *Tipperary*, .	ALEX. M'RAE, Forester, Dundrum.

APPENDIX F.

Additions to the Library since the publication of the List in Volume XXXII., Part 2.

Books.

1. *Forestry Work.* By W. H. Whellens.
2. *Australian Forestry.* By D. E. Hutchins.
3. *Seaside Planting.* By A. D. Webster.
4. *Report of Smithsonian Institution*, 1917.
5. *New Zealand Official Year-Book*, 1917.
6. *Transactions of the Highland and Agricultural Society*, 5th series, vol. 30, 1918.
7. *The Development of Forest Law in America.* By J. P. Kenney, LL.B.
8. *Essentials of American Timber Law.* By J. P. Kenney, LL.B.
9. *National Afforestation.* By A. D. Webster.

Government and State Reports.

10. England :—
    (1) *Report of Commissioners of H. M. Woods and Forests*, 28th June 1918.
    (2) *8th Report of the Development Commissioners to 31st March* 1918.
    (3) *Report of Forestry Sub-Committee of the Reconstruction Committee*, 1918.
    (4) *Report of the Agricultural Policy Sub-Committee of the Reconstruction Committee*, 1918.
11. India :—
    (1) *Statistics relating to Forest Administration*, 1916-17.
    (2) *Report of Forest Department of Madras, year to 30th June* 1918.
12. Indian Forest Records :—
    (1) Vol. vi., part 4—*Further Note on Antiseptic Treatment of Timber*, 1918.
    (2) Vol. vi., part 5—*Statistics compiled by Silviculturist*, 1916-17.
    (3) Vol. vi., part 6—*Note on the preparation of Turpentine, Resin, and Gum, etc.*, 1918.
    (4) Vol. vii., part 1—*Preliminary Note on seasoning of some Indian Timber by Natural Methods.*
13. Australia :—*Reports relating to Afforestation in Federal Capital Territory.*
    South Australia :—*Report on State Forest Administration*, 1917-18.
    Western Australia :—*Report of the Woods and Forests Department to 31st December* 1917.
14. New Zealand :—
    (1) *State Forest Report, year to 31st March* 1918.
    (2) *Results of a Census, 15th October* 1916. Part 1. "Population."
    (3) *Waipoua Kauri Forest—its Demarcation and Management.* By D. E. Hutchins.

15. Canada :—
    (1) *Report of the Director of Forestry*, 1918.
    (2) *Canadian Bark Beetles*, part 2, 1918. (Bulletin No. 14.)
    (3) *Wood-using Industries of Quebec*, 1918. (Bulletin No. 63.)
    (4) *Forest Fires in Canada*, 1914-16. (Bulletin No. 64.)
    (5) *Quelques aperçus sur les Bois de l'Australie Occidentale*, 1918.
    (6) *Creosote Treatment of Jack Pine and Eastern Hemlock for Crossties.* (Bulletin No. 67.)
    (7) *Conservation of Life.*
16. Federated Malay States :—*Report on Forest Administration*, 1917.
17. United States of America :—
    (1) Bulletin No. 680. *Miscellaneous Conifers of the Rocky Mountain Region.* By George B. Sudworth.
    (2) Pennsylvania :—*Report of Chief Forest Fire Warden*, 1917.
    (3) California :—*Publications of the College of Agriculture.*

Societies' and Institutions' Reports and Transactions.

18. England :—
    (1) Association of Economic Biologists. *Annals of Applied Biology*, vol. v., Nos 1, 2, 3 and 4.
    (2) *Journal of the Royal Agricultural Society*, vol. lxxviii., 1917.
    (3) *Journal of the Royal Horticultural Society*, vol. lxxiii., parts 1, 2 and 3.
19. Ireland :—
    Royal Dublin Society : Scientific Proceedings, vol. xv., Nos. 24 to 34.
20. Scotland :—
    (1) Royal Botanic Garden :—*Notes for November* 1917, *and July and November* 1918.
    (2) Botanical Society of Edinburgh : — *Transactions*, vol. xxvii., parts 2 and 3, 1916-18.
21. Nova Scotia :—
    Proceedings and Transactions of Nova Scotia Institute of Science, vol. xiv., part 3, 1916-17.

Reprints and Miscellaneous.

22. Journal and Leaflets of the Board of Agriculture. London
23. Journal of the Department of Agriculture. Dublin
24. *Journal of Agriculture.* Victoria.
25. *The Estate Magazine*
26. *L'Alpe.* Firenze.
27. *Tidskrift for Skogsbrug.* Christiania.
28. *Skogsvårdsföreningens Tidskrift.* Stockholm.
29. *Meddelanden Från Statens Skogsförsöksanstalt.* Stockholm.
30. *The Indian Forester.*
31. *Journal of Forestry.* Washington.

32. *Canadian Forestry Journal.*
33. *Timber Trades Journal.*
34. *Timber News.*
35. *Mededeelingen Van's Rijks Herbarium, Leiden*, Nos. 28-37.
36. *The History of the London Plane.* By Augustine Henry and Margaret Flood.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

A. W. BORTHWICK, D.Sc.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

VOL. XXXIV.

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1920.

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The Society does not hold itself responsible for the statements or views expressed by the authors of papers.

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The Essentials of American Timber Law. By J. P. Kinney, A.B., LL.B., M.F. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. 118

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Conifers and their Characteristics. By Charles Coltman-Rogers. London: John Murray. Pp. ix+333. Price 21s. net 224

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TRANSACTIONS

OF THE

ROYAL
SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XXXIV.—PART I.

January 1920.

A. W. BORTHWICK, D.Sc.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

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Royal Scottish Arboricultural Society

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[CONDITIONS OF MEMBERSHIP, see Over.

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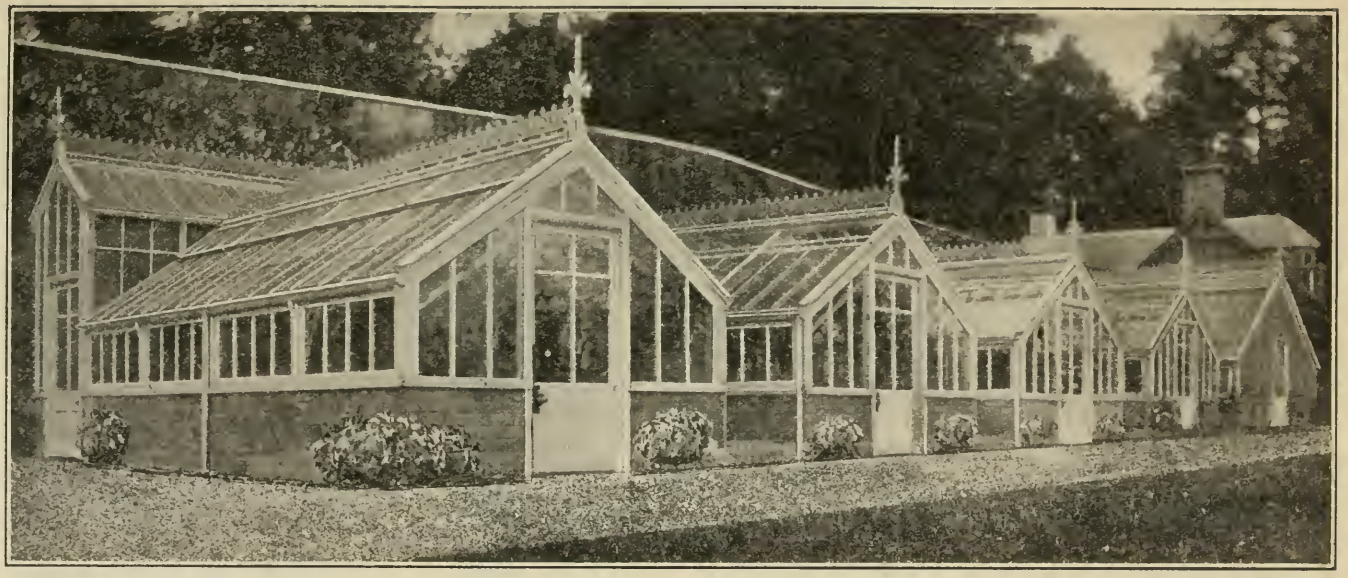

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

1. Report of the General Meeting held in the Highland and Agricultural Society's Show, The Meadows, Edinburgh, on 10th July 1919.

The Duke of Buccleuch, President of the Society, was in the chair, and after the minutes of the last Annual Business Meeting had been read and approved, he called upon Mr Milne Home to present the reports of the Judges on the Essays received.

Mr Milne Home, in announcing the result of the Competition, said:—"On behalf of the Judges of the Essays I would like to make known to this Annual Meeting that the Essay which has been awarded the Gold Medal we thought was of particularly high merit. In fact, speaking for myself, since I have had to do with these Essays I am quite satisfied I have never seen such an excellent Essay as this before. Therefore we decided to recommend the award of the Gold Medal, which has not been given by this Society for some years. I hope that in due course the Essay may be published in the *Transactions*. The second Essay received the No. 1 Silver Medal. It is also of very considerable merit and contained a good deal of valuable original matter, and I hope that that also may be published."

The Forestry Exhibit.

Mr Robert Allan, Polkemmet, Whitburn.—"I think the Society may congratulate itself on this the first Exhibition after the serious war which we have come through. I think it is one of the best Exhibitions that the Society has ever held. My duty as Convener of the Committee is to ask you to give a vote of thanks to the Highland and Agricultural Society for the site of the Exhibit, and their usual grant of £20. Of course we have no prizes this year, but the Highland Society very considerately allowed us to use the money in connection with

the Exhibition, and I think the result should satisfy the most critical. I have also to ask you to give a vote of thanks to the Board of Trade Timber Supply Department, of which our Honorary Secretary, Sir John Stirling-Maxwell, is the head. As you are aware, most of the exhibits have been sent by that Committee, and show the work they have been doing during the war, and the quality of timber which can be grown in our own country. We have also been indebted to many others, and I would like to mention Messrs Sounnes and Spiers who have made very useful contributions, and have also assisted materially in getting the exhibits put into order. Another feature of the Exhibition, which I am sure must have struck most of you, is the very excellent series of enlarged photographs which take up a considerable amount of space in our huts. We are indebted for these to Sir John Stirling-Maxwell, and they show in a very clear manner the work of the Timber Supply Committee. We have also to thank Colonel Sutherland of the Board of Agriculture for many beautiful photographs of the work done by our men in France. We have been very ably assisted by Mr Pike in the arrangement of the exhibits, and have also to thank him for many useful contributions from the University collection. To Mr Massie of Messrs Dicksons & Co., Nurserymen, Edinburgh, we are greatly indebted for the floral baskets and decoration of the grounds. The whole Exhibition will be a revelation to many who have hitherto been interested in forestry, but the educational effect on the general community I think can hardly be over-estimated at a time such as this, when the reconstruction of our industry is taking place and we are hoping to see a great development in forestry operations in Scotland. It should also do a great deal of good in removing misconception on the part of many as to the policy of the Royal Scottish Arboricultural Society. There have been suggestions made that the exhibits are of such a useful kind that it is a pity they should only be on view for four days. The Council had the matter before them at a meeting previous to this, and I asked a remit to approach the Edinburgh Town Council and inquire whether they could house these exhibits and other exhibits which we might get, which would be open to the public in Edinburgh and to visitors, in one of their public parks. The Council have granted that remit, and we will approach Edinburgh Corporation and ask them to give us the privilege of housing this excellent exhibit

for a few years, at any rate until permanent accommodation can be got. I ask you to give a vote of thanks to those I have named."

Sir John Stirling-Maxwell.—"Will you allow me to explain that Mr Allan has given me credit for these photographs in the Exhibition which does not entirely belong to me. They were made by Mr Walter Bell, and I think our Society has good reason to be grateful to him for the time he has voluntarily given to that work, and for the many journeys he has made in order to secure these photographs."

The Chairman.—"I think there is no question that this Show is extremely successful, and we ought to accord thanks to those who have got it up. I hope it will be a permanent benefit to forestry in this country. I would like, if I may, to ask Mr Brand to say a few words. He is one of the many who have worked very hard for this Exhibit."

Mr Brand, of the Board of Trade Timber Supply Committee, said:—"I wish to draw particular attention to the samples of wood for commercial purposes. A whole table or stage is covered with articles made from home timber during the war, which before were to a greater or less extent imported. In particular, you would notice a panel of 3-ply wood. That is being manufactured now in Scotland and a great deal of it in England, and it is interesting to know that timber grown in Scotland is now being veneered and put into tea-chests and used for similar purposes. The same remarks apply to basket-making. The wood for fruit-baskets was nearly all imported, but they are able now, in Glasgow particularly, to use our Scots pine and veneer it and utilise it for purposes of that kind. A great business is being done and premises are being extended to cope with the demand for the home article. I have also in my hand a sample that I got as a privilege to show at this Exhibition, but as it is a very scarce commodity, I hesitated to put it in the Exhibition, but I will place it on the table here, and any member may have the opportunity of examining it when the meeting is over. It is a part of the oak that was taken off the roof of Glasgow Cathedral. It is supposed to be made from a piece that had been in the roof for over 700 years, and the material is originally supposed to have been grown at Loch Lomond. It has stood well, and is quite fresh in every way. I hope, if the Exhibition is removed to a permanent

place, we will be able to add other samples of our home commercial timber."

Mr A. D. Richardson.—"With regard to the proposal to have the exhibit housed permanently, some time ago this Society made representations to the Royal Scottish Museum Authorities to have an exhibit of British Columbian timber housed in the Museum, but the application was refused on the ground that they had no room for it. A very large addition has, however, been made recently to the Museum, and I think that is the place where this very excellent exhibit should be housed, and become the nucleus of a great national timber collection. I do not agree at all with the Council's idea of applying to the Corporation for housing accommodation for this exhibit. It is far more than a municipal thing. It is a national thing, and the proper place for it is in a national institution, and the proper institution is the Royal Scottish Museum, and I think application should again be made to the Museum Authorities to have this exhibit housed there."

Mr Allan.—"The Council have very carefully considered the matter, and this arrangement is not supposed to be permanent. It is only a stop-gap. We hope that there will be other exhibits of an educational kind, which, in the near future, will require to be housed in some national building. We hope that will come. We also considered the question of the British Columbian exhibit, but Mr Richardson knows the difficulty we have always been up against in connection with the Museum."

Roads of Remembrance.

Colonel Sutherland.—"The motion which has been allotted to me will, I hope, not take many words to ensure your support. A movement has taken life in America and in France in which, I think, we ought to participate in this country. The movement aims at the beautifying of the country and the towns in memory of the men who have suffered and fallen in the Great War, now fortunately ended. An Association has been formed in England, with which, I think, we ought to co-operate in Scotland, and it is hoped by the Association in England that a strong Executive will be created in Scotland to further the object. It is said that a large number of new roads are to be made in this country, and many new schemes for the promotion of housing are supposed also to be on the *tapis*, and in the making

of such roads, and in the construction of the villages, I think it must appeal to you that the main avenues, the main streets, and sometimes the parks, might be planted with trees in honour of the men who have served their country well and faithfully and have given their lives, and also, possibly, in memory of the great achievements of the various Scottish regiments in the field. A great deal of the planting, I think, might be done properly by relatives and friends of those who have gone before, but some of it must necessarily be done by others, and it is suggested that nobody could better undertake the work than boys and girls at school, and possibly the Boy Scouts and other combinations of young people will do what is wanted, and have before them a lasting memorial of those men who have gone and of the deeds that they have achieved. In many of the country and town schools there are corners where trees might be planted, and as your motto says 'Stick in a tree and it will be growing when you are sleeping,' I hope these trees will grow in another way. They will grow in the minds and in the imaginations of the rising generation and of generations to come, and be emblematical of the great and heroic deeds done for our country by those who have gone before. The resolution that I am asked to submit is, 'That this Society unanimously support the "Roads of Remembrance" movement for the planting of trees in public highways, public parks, and other places to the memory of soldiers who have fallen in the war, or in honour of the brave deeds or outstanding successes of our Scottish regiments.' I would just like to say that I am assured by the Authorities in Edinburgh that we will have the advantage of their support here, and I am sure that will follow in Glasgow and all the various large and small towns, and I would venture to suggest that, as our President is to-day to plant a tree, that it might be planted to the memory of those members of these societies that have been killed in the war. I make this suggestion with diffidence because I have not had an opportunity of consulting the President on the subject, but I do think it might give the movement a start, and I will be very glad if you will agree to it."

Mr M'Hattie seconded the motion.

The Chairman.—"I think it is an excellent idea myself. Of course, we know in the past there has been considerable difficulty in planting trees in the highways and other places, on account

of the damage done to them, but if the trees are to be in the hands of the school children, and looked upon as a national possession, so that everyone will have an interest in them, I think there may be a very considerable future for the movement. We all know there are many places where it has been a great success in the past. I quite agree with Colonel Sutherland's suggestion about the tree I am to plant after this meeting is over."

The motion was carried unanimously.

Proposed Imperial Forestry Conference.

The Chairman.—"There is a proposal to have an Imperial Forestry Conference in the autumn, but I am afraid I cannot give any definite information about it. Last week, before I came to Scotland, I had a telephone message asking if I could attend a meeting in London last Friday, but I was unable to do so. We tried to get some other member of the Society, but neither Sir John Stirling-Maxwell nor Colonel Balfour were able to attend. I have not yet heard what happened at that Conference, but I took it upon myself to inform them, because it had already been up before the Council, that any such Conference to be held in this country would have the cordial support of our Society. I feel confident I was interpreting your wishes in saying that, but I would be obliged to you if you would confirm it."

Lord Lovat.—"A preliminary meeting of the Committee, appointed by the Interim Authority, to consider this question, was held last week, and a further meeting will be held on the 15th, at which it is hoped your Society will be represented."

The Forestry Bill.

The Chairman.—"The next item is the Forestry Bill. As you are probably all aware the Forestry Bill was introduced in the House of Lords, and the second reading took place on Monday. Unfortunately it was quite impossible for me to be there. This Society has on many occasions passed resolutions in favour of such a Central Authority being constituted. I do not wish to go into the details of the Bill because others can perhaps deal with it better than I could, but I would like to move 'That this Society cordially welcomes the introduction of the Forestry Bill,

and hopes it will be soon passed into law.' Of course it is very easy to criticise any Bill. Apart from creating the Authority you will notice that the decision as to what land should be taken rests with the Development Commissioners. That is, so far as I understand, the Forestry Commission would recommend certain land, and the decision would come before the Development Commissioners. Also the schedule of the Bill deals largely with the taking of land. I do not wish to go into that, because it probably does not affect us as a Society, but I think there may be certain criticisms of the procedure and proposals, although possibly from the agricultural point of view, but I hope that in the passage through Parliament certain dangers which are somewhat obvious will be explained away, or will be safeguarded against, because I think there is one thing we do not wish to run counter to, and that is agricultural operations. I am alluding specially to sheep farms, of which, apparently, under the Bill a portion can be taken and the rest, perhaps, rendered useless. However, I may be wrong in that respect. There is a letter from Mr Acland, the Chairman of the Interim Forestry Committee, in answer to some questions put by our secretary. I think it would be desirable that the meeting should hear this letter."

The Secretary.—"There was some anxiety expressed by one or two members to me about the position of the local bodies under this Bill. They thought, perhaps, that their powers were not sufficiently emphasised under the Bill, and I had an opportunity of speaking to Mr Robinson, one of the members of the Interim Forest Authority, on this subject, and suggested that he might make that point quite clear so that I could re-assure anyone who was in doubt about it. Mr Robinson subsequently talked the matter over with the Chairman of the Interim Forest Authority, from whom I received a letter in which he stated:—'The policy of the Government and of the Forest Authority is to arrange that all the executive and administrative work shall be done, so far as Scotland is concerned, under the control of Scottish officers with headquarters in Edinburgh.'"

Mr James Whitton, Glasgow.—"I have pleasure in seconding the motion. I am very glad that letter has been read, because a great deal of misapprehension has arisen on account of the letters that appeared in the papers, which I think have emanated mainly from our agricultural friends under a misconception of

what forestry means, and I hope this will clear the ground, for it shows the two bodies ought to work in harmony."

Mr Richardson.—"While it is right that the Society should pass a resolution welcoming this Bill, I think we ought to do a little more in examination of the Bill itself. It is all very well to have letters assuring us that certain things will be done, but that does not satisfy a great many of us. There is not in the Bill a single word to the effect that even one of the officers who are to be appointed shall have any knowledge whatever of forestry. The seven Commissioners are appointed by the King, and the Assistant Commissioners for each of the three countries are to be appointed by these Commissioners, and the Advisory Committee is to be composed of people, according to the Bill, who may not have any knowledge whatever of forestry. They are to be representatives of bodies interested in forestry, and of bodies who are interested in matters or have experience of matters connected with forestry. I do not think people will be satisfied until it is made perfectly clear in the Bill that the people who are to be appointed are men capable of carrying out the work. As to the seven Commissioners, there is no stipulation in the Bill that any proportion of these are to represent Scotland. The whole seven may be Englishmen. Is Scotland to take its policy from seven English Commissioners sitting in London or anywhere else? Supposing you had an Assistant Commissioner who knew his work, and seven Commissioners who did not know about forestry, and the Assistant Commissioner refused to carry out their orders, he would probably be dismissed. I supported the Central Authority with an executive in the different countries, but I was surprised when I saw the Bill. I expected the Advisory Committees would be Committees of men who are experts in practical forestry, not men merely interested in matters connected with forestry, which might include toymakers, shipbuilders, and so on. I am prepared to move the following amendment, 'While this Society welcomes the introduction of the Forestry Bill into Parliament, it protests against the constitution of the Central Authority in so far as no provision is made for Scotland's claim to have representation thereon commensurate with her needs, and that no qualifications either for the post of Commissioner or the Assistant Commissioner are mentioned in the Bill. It also protests against the constitution of the Consultative Committees,

in so far as none of the members whom it is proposed to appoint may have any practical or scientific knowledge of silviculture.'"

Mr W. H. Menmuir.—"I have great pleasure in seconding, although I was dead against a Central Forest Authority in England. I disagree with the way this Bill is to be worked. There is no mention in the Bill that any of the Commissioners are to be Scotsmen. We ought to see that the forest policy of Scotland is worked thoroughly in Scotland. Mr Richardson is quite within his rights in asking for a proper point of view in regard to Scottish forestry. We want to see men in Scotland who are capable of carrying out practical forestry, and also some who have a knowledge of theoretical forestry, getting posts under this scheme."

Sir John Stirling-Maxwell.—"As a member of the Committee upon whose recommendations this Bill is based, I wish to say that the fears which have been expressed by the last two speakers, although natural, are quite groundless. I think I am right in saying that no Bill ever meets the kind of points which they have raised. Those are points which come up in debate on the Bill, and no doubt they will be discussed in Parliament. The object of the Bill is to give the Government powers to carry out the forestry policy, and the Bill is directed to that object, and to no other. As regards the character of the appointments to be made as representing our country upon the Central Authority, we can judge pretty well from what the Government has actually done. They have instituted an Interim Authority which I imagine, if the ordinary practice is followed, will become the permanent Authority as soon as the Bill is passed. On that Interim Authority we have more than our share of Scotsmen. There are Lord Lovat, Colonel Fothringham, Mr M'Callum Scott, one of our Scottish representatives in the House of Commons, and another, Lord Clinton, is as much connected with Scotland as with England, though of English birth. That surely is a strong enough representation on a body of seven, and I have no reason to suppose that with regard to the Executive Department in Scotland, the ordinary practice will not be followed, and the Department over which Mr Sutherland presides here, will go bodily over to the Commissioners, and that he will remain in charge of forestry in Scotland. All those things would naturally follow, but it would be quite contrary to precedent to put these

things into the Bill. Therefore, if I may say so, this point has really been raised under a misapprehension. There is nothing in the amendment with which we could not all agree, but in asking that the names of every one concerned should be entered in the Bill, I think we are asking for what Parliament would not be able to give."

Mr Richardson.—"I do not quite agree with that. Why is it necessary to define what the nature of the consultative bodies is to be if it is not necessary to define what the qualifications of the Commissioner and the Assistant Commissioners are to be?"

Sir Hugh Shaw-Stewart.—"Seeing it is quite impossible to get all the details in the Bill, would Mr Richardson not be satisfied with a motion to the effect that a small Committee of the Council be instructed to keep a watch over the Bill during its passage in Committee and see that the claims of Scotland are in no way overlooked? Would he not change his amendment for some such words as these? That would meet his case."

Mr Milne Home.—"Under Section 6 of the Bill, sub-section 2, doesn't it give a guarantee that persons having practical experience of matters relating to forestry would be appointed, and under another sub-section representatives of Labour?"

Lord Lovat.—"I was instructed by Mr Acland, with Colonel Fothringham, who is here too, to attend this meeting and see exactly the sort of points that might be raised, such as have been raised by the mover and seconder of this amendment. May I say straight away that these are obviously committee rather than Bill points, which you can't put into the Bill? It is very rare indeed, in fact I think there is hardly a case where the actual members of any Commission are named before that Commission comes before the House. You must obviously see that the mere naming of any single individual for any post must make very few friends and a great many enemies for the people who put him there. Therefore, that would be quite impracticable. On the question of having practical men, I would like to assure the mover and seconder that this matter has been fully discussed by the Committee at practically every meeting we have had. We were absolutely of the opinion that the words 'practical men,' which occur twice in the course of the Bill, were put in with the definite purpose of ensuring

that the department was staffed by practical men and not amateurs. I only speak as a member of the Interim Authority, but I should have great pleasure in looking over this matter again, and suggesting to Mr Acland that if it is not quite clear that this brings out the fact that we are to have practical men and practical Scotsmen to run these affairs, that an amendment should be suggested to His Majesty's Government to have that incorporated. We have had very much more criticism from other places than Scotland of having too many Scotsmen connected with this affair rather than too few, but it is a very good thing also to see that the other side is put forward. In all the discussions which we have had the idea has been prevalent that, while you must have, in the initial stages of work such as this, men who have got a certain experience of administration, at the earliest possible time a really big United Kingdom Forestry Service is to be built up so that one personnel could carry out the whole of the work. May I put this to those people who wish to press the claim of any district, that you cannot have your cake and eat it? If you have a single personnel that is going to give you the best brains, if you have a single authority, Scotsmen can be promoted, and their promotion will not necessarily be confined to this kingdom. On consideration, you will see that it is to the advantage of the best man to have as many billets as possible open to him, so that he can climb to the top of the ladder if he has the brains and the intelligence to stick up there. It is for this reason that in France they are so determined on this principle of one personnel that they even included in the French Administration the whole of the Algerian forests, and the difference between these cases is much greater than that between Scotland and England. You should not have too many limiting factors put into the Bill, because you cannot take them out afterwards. This is a matter which should be left to the common sense of the Government when appointing these people, but I shall certainly bring the matter again before Mr Acland. I think the leading article in this morning's *Scotsman* makes a very fair point of criticism on the question that what we do want now is to get ahead with some work, or to put it in the words of the Agriculturist, Mr John Jorrocks, 'Let's cut the cackle and get to the 'osses.' We do want to get something done. There is always the danger in a crowded session of having a

measure wrecked. We want, if our objectives are not too large, to back, if possible, something that is going right through. The question raised by the *Scotsman* this morning was a perfectly fair one. It will be necessary to bring the question of small-holdings tightly up in connection with the question of forestry development. It is to many of us the main centre and drive of the whole forestry policy to get a larger number of small-holders settled on the land, and in order to do that—and it is one of the ideas that has always been discussed in our Committee, and to which effect is given in the Bill, in the very words now taken exception to—we can have, and shall have, representation on the Consultative Committee of the Board of Agriculture, so that every scheme for forestry can be looked at from the agricultural and the forestry side, before it is given effect to. It is those sort of things which we must keep open in order to get the men you want, and I would strongly advise the Committee not to narrow down the words too far and keep out people that you would wish to have in."

Mr Menmuir.—"I would point out that there is no similarity between France and Britain. France is a nation by herself, and works her whole policy from Paris. But this is a question of a Central Authority in London controlling the forestry of three countries."

The motion was carried by a large majority—only 12 voting for the amendment.

2. The Forestry Act, 1919.

We print in full below the text of this Act. Copies of the original can be obtained from H.M. Stationery Office, 23 Forth Street, Edinburgh, at a cost of 2d.

An Act for establishing a Forestry Commission for the United Kingdom, and promoting afforestation and the production and supply of timber therein, and for purposes in connexion therewith. [19th August 1919.] A.D. 1919.

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :—

Establishment of Forestry Commission

1.—(1) For the purposes of this Act, it shall be lawful for His Majesty by warrant under the sign manual to appoint eight commissioners, to be styled the Forestry Commissioners, of whom one, to be appointed by His Majesty, shall be chairman, and of whom not less than two shall have special knowledge and experience of forestry in Scotland, and one at least shall be a person having scientific attainments and a technical knowledge of forestry.

(2) There shall be paid to not more than three of the Forestry Commissioners, in this Act referred to as "the Commissioners," such salaries in each year (not exceeding in the aggregate four thousand five hundred pounds) as the Treasury may direct.

(3) Subject to the provisions of this section, the term of office of a Commissioner shall be five years.

(4) On a casual vacancy occurring owing to the death, resignation, or incapacity of a Commissioner, the person appointed by His Majesty to fill the vacancy shall continue in office until the date on which the Commissioner in whose place he was appointed would have ceased to hold office.

(5) A person who has vacated office as a Commissioner shall be eligible for re-appointment.

(6) One of the unpaid Commissioners shall be a member of the Commons House of Parliament.

Proceedings, staff, and seal of Commissioners.

2.—(1) The Commissioners may act by three of their number and notwithstanding a vacancy in their number, and may regulate their own procedure.

(2) The Commissioners may, subject to the approval of the Treasury as to number, appoint and employ such officers and

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servants for the purposes of this Act as they think necessary, and may remove any officer or servant so appointed or employed, and there shall be paid to such officers and servants such salary or remuneration as the Commissioners may, with the consent of the Treasury, determine.

(3) The Commissioners may sue and be sued, and may for all purposes be described by the name of "the Forestry Commissioners," and shall have an official seal which shall be officially and judicially noticed, and the seal shall be authenticated by any Commissioner or the secretary to the Commissioners, or some person authorised by the Commissioners to act on behalf of the secretary.

(4) Every document purporting to be an order or other instrument issued by the Commissioners and to be sealed with the seal of the Commissioners authenticated in manner provided by this section, or to be signed by the secretary to the Commissioners or any person authorised by the Commissioners to act on behalf of the secretary, shall be received in evidence and be deemed to be such order or instrument without further proof, unless the contrary is shown.

31 & 32 Vict. c. 37. 45 & 46 Vict. c. 9.

(5) The Documentary Evidence Act, 1868, as amended by the Documentary Evidence Act, 1882, shall apply to the Commissioners as though the Commissioners were included in the first column of the schedule to the first-mentioned Act, and the chairman or any other Commissioner or the secretary, or any person authorised to act on behalf of the secretary, were mentioned in the second column of that schedule, and as if the regulations referred to in those Acts included any document issued by the Commissioners.

Powers and duties of Commissioners.

3.—(1) The Commissioners shall be charged with the general duty of promoting the interests of forestry, the development of afforestation, and the production and supply of timber, in the United Kingdom, and shall exercise and perform any powers and duties which are or may be conferred or imposed on, or transferred to, them under the provisions of this Act.

(2) There shall be transferred to the Commissioners the powers and duties of the Board of Agriculture and Fisheries, the Board of Agriculture for Scotland, and the Department of Agriculture and Technical Instruction for Ireland in relation to forestry, and also the powers of those Departments under the

Destructive Insects and Pests Acts, 1877 and 1907, so far as those powers relate to insects or pests destructive only to forest trees and timber, but, so far as they relate to other insects or pests destructive or injurious alike to fruit trees or farm crops and to forest trees and timber, the Commissioners shall exercise such powers in consultation with the said Departments: A.D. 1919. 40 & 41 Vict. c. 68. 7 Edw. 7. c. 4.

Provided that the Departments from whom the powers and duties aforesaid are transferred to the Commissioners shall, if arrangements are made for the purpose, continue to exercise and perform on behalf of the Commissioners such of the transferred powers and duties as may, from time to time, be agreed between the Commissioners and the Department concerned.

(3) Subject to any directions which may be given by the Treasury, the Commissioners shall have power to do any of the following things:—

(*a*) Purchase or take on lease and hold any land suitable for afforestation or required for purposes in connexion with afforestation or with the management of any woods or forests, and manage, plant, and otherwise utilize any land acquired, and erect such buildings or execute such other works thereon as they think necessary:

(*b*) Sell or let any land which in their opinion is not needed or has proved unsuitable for the purpose for which it was acquired, or exchange any such land for other land more suitable for that purpose, and pay or receive money for equality of exchange:

(*c*) Purchase or otherwise acquire standing timber, and sell or otherwise dispose of any timber belonging to them, or, subject to such terms as may be mutually agreed, to a private owner, and generally promote the supply, sale, utilisation, and conversion of timber:

(*d*) Make advances by way of grant or by way of loan, or partly in one way and partly in the other, and upon such terms and subject to such conditions as they think fit, to persons (including local authorities) in respect of the afforestation (including the re-planting) of land belonging to those persons:

(*e*) Undertake the management or supervision, upon such terms and subject to such conditions as may be agreed upon, or give assistance or advice in relation to the

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planting or management of any woods or forests belonging to any persons, including woods and forests under the management of the Commissioners of Woods or under the control of any Government Department, or belonging to any local authority:

(*f*) Establish and carry on or aid in the establishment and carrying on of woodland industries:

(*g*) Undertake the collection, preparation, publication and distribution of statistics relating to forestry, and promote and develop instruction and training in forestry by establishing or aiding schools or other educational institutions, or in such other manner as they think fit:

(*h*) Make or aid in making such inquiries, experiments and research, and collect or aid in collecting such information, as they may think important for the purpose of promoting forestry and the teaching of forestry, and publish or otherwise take steps to make known the results of such inquiries, experiments or research and to disseminate such information:

(*i*) Make or aid in making such inquiries as they think necessary for the purpose of securing an adequate supply of timber in the United Kingdom and promoting the production of timber in His Majesty's dominions:

Provided that any advance by way of a grant under this section shall be subject to the condition that any profits resulting from the operations in respect of which the grant was made shall, after allowing for a return to the owner of four per cent. compound interest on the cost incurred by him (exclusive of the amount of the grant), be charged with the repayment to the forestry fund of the amount of the grant together with compound interest at four per cent.

Any question arising between the Commissioners and the owner with respect to the amount of any repayment under this proviso shall, in default of agreement, be decided by a person nominated by the President of the Surveyors' Institution, and, for the purposes of this proviso, the expression "owner" means the person for the time being entitled to the profits on the operations in respect of which the grant was made: Provided also that, before acquiring any land under this Act and before selling or otherwise disposing of any land so acquired, but not required by them for the purposes of this Act, the Commissioners shall

consult the appropriate agricultural department, and, in the case of land proposed to be sold or disposed of, shall give that department an opportunity of acquiring the same. A.D. 1919

The appropriate agricultural department shall be in England and Wales the Board of Agriculture and Fisheries, in Scotland the Board of Agriculture for Scotland, and in Ireland the Department of Agriculture and Technical Instruction for Ireland.

(4) An advance shall not after the commencement of this Act be made under subsection (1) of section one of the Development and Road Improvement Funds Act, 1909, for the purposes of forestry, unless before that date the Development Commissioners have made and the Treasury have approved a recommendation for the advance. 9 Edw. 7. c. 47.

(5) It shall be lawful for any of the persons under a disability referred to in section seven of the Lands Clauses (Consolidation) Act, 1845, or of the Lands Clauses (Consolidation) (Scotland) Act, 1845, to enter into agreements with the Commissioners for the purposes of this section in like manner in all respects as they are entitled to enter into agreements for the purposes of those sections. 8 & 9 Vict. c. 18. 8 & 9 Vict. c. 19.

(6) In this section the expression "timber" includes all forest products.

Prevention of damage by rabbits and vermin.

4.—(1) Where the Commissioners are satisfied that trees or tree plants are being or are likely to be damaged by rabbits, hares or vermin owing to the failure of an occupier of land to destroy sufficiently the rabbits, hares or vermin on the land in his occupation, or otherwise taking steps for the prevention of such damage, the Commissioners may, after giving to the occupier and owner such opportunity of destroying the rabbits, hares or vermin, or taking such steps as aforesaid, as in the opinion of the Commissioners is reasonable, authorise in writing any competent person to enter on the land and kill and take the rabbits, hares or vermin thereon, and the Commissioners may recover from the occupier summarily, as a civil debt, the net cost incurred by them in connexion with the action so taken.

(2) Any person acting under an authority given by the Commissioners under this section shall, if so required, produce his authority, and, if any person obstructs any person so authorised in the due exercise of his powers or duties under this section, he shall be liable on summary conviction to a fine not exceeding twenty pounds.

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(3) The person entitled to kill rabbits, hares or vermin on any common lands shall, for the purpose of this section, be deemed to be the occupier of the land.

(4) For the purpose of this section, the expression "vermin" includes squirrels.

Appointment of assistant commissioners to act for England, Scotland, and Ireland.

5.—(1) For the purpose of exercising in England and Wales, Scotland, and Ireland, respectively, the administrative powers and duties of the Commissioners (other than those relating to statistics, instruction and training, inquiries, experiments and research), and such of their other powers or duties as the Commissioners may determine, the Commissioners shall appoint three persons to be assistant commissioners, of whom one shall be appointed as assistant commissioner for England and Wales, one for Scotland, and one for Ireland.

(2) The salaries of the assistant commissioners shall be such as the Treasury may determine, and the Commissioners may from time to time remove any assistant commissioner and appoint another person to be assistant commissioner in his place.

Consultative committees for England, Scotland, Ireland, and Wales.

6.—(1) It shall be lawful for His Majesty, by Order in Council, to establish consultative committees for England, Scotland, Ireland, and Wales, respectively, for giving to the Commissioners in accordance with the provisions of the Order advice and assistance with respect to the exercise and performance by the Commissioners of their powers and duties under this Act.

(2) The constitution of each consultative committee shall be such as may be determined by the Order, so, however, that the Order shall provide for the inclusion among the members of the committee of—

(*a*) a representative, in the case of the English Committee and the Welsh Committee, respectively, of the Board of Agriculture and Fisheries, in the case of the Scottish Committee, of the Board of Agriculture for Scotland, and in the case of the Irish Committee, of the Department of Agriculture and Technical Instruction for Ireland;

(*b*) persons having practical experience of matters relating to forestry, woodcraft, and woodland industries;

(*c*) representatives of labour;

(*d*) representatives of county councils and any other local bodies interested in forestry;

(*e*) representatives of societies existing for the promotion of afforestation; A.D. 1919.

(*f*) representatives of woodland owners.

Compulsory acquisition of land.

7.—(1) If the Commissioners are unable to acquire by agreement and on reasonable terms any land which they consider it necessary to acquire for the purpose of this Act, they may apply to the Development Commissioners for an order empowering them to acquire the land compulsorily in accordance with the provisions of the Schedule to this Act, and the Development Commissioners, after giving the owner of such land an opportunity of being heard against such compulsory purchase, shall have power to make such order.

(2) No land shall be authorised by an order under this section to be acquired compulsorily which, at the date of the order, forms part of any park, demesne, garden, or pleasure ground, or forms part of the home farm attached to and usually occupied with a mansion house, or is otherwise required for the amenity or convenience of any dwelling-house, or which at that date is the property of any local authority, or has been acquired by any corporation or company for the purposes of a railway, dock, canal, water, or other public undertaking, or is the site of an ancient monument or other object of archæological interest.

(3) Where an order made by the Development Commissioners under this Act authorises the acquisition of any land forming part of any common, open space, or allotment, the order, so far as it relates to the acquisition of such land, shall be provisional only, and shall not have effect unless and until it is confirmed by Parliament, except where the order provides for giving in exchange for such land other land, not being less in area, certified by the Board of Agriculture and Fisheries to be equally advantageous to the persons, if any, entitled to commonable or other rights, and to the public:

Provided that the foregoing provision shall not apply if the order provides for the granting to the public of reasonable access to the land for air, exercise or recreation, unless the land to be acquired has been dedicated to the public use and enjoyment, or is a metropolitan common within the terms of the Metropolitan Commons Act, 1866, or is a suburban common as defined by the Commons Act, 1876, or is subject to a scheme of regulation made in pursuance of the Metropolitan Commons Acts, 29 & 30 Vict. c. 122. 39 & 40 Vict. c. 56. 8 & 9 Vict. c. 118.

A.D. 1919. 62 & 63 Vict. c. 30.

1866 to 1898, or the Inclosure Acts, 1845 to 1882, or the Commons Act, 1899, or to a private or local Act of Parliament.

(4) Where the Commissioners are of opinion that insufficient facilities exist for the haulage of timber from any wood or forest to a road, railway, or waterway, they may make an order that the owner and occupier of any land shall afford the necessary facilities, subject to payment by the person in whose favour the order is made of reasonable rent or wayleave and of compensation for any damage caused by such haulage, and the owner or occupier of such land shall thereupon afford such facilities; and the amount of rent or wayleave and compensation shall, in default of agreement, be assessed by a single arbitrator appointed by the President of the Surveyors' Institution:

Provided that the Commissioners shall not make any order under this subsection until the person proposed to be required to give such facilities as aforesaid has had an opportunity of being heard, and any person aggrieved by an order made under this subsection may appeal therefrom to the Development Commissioners in such manner and upon such conditions, if any, as may be prescribed by them, and the Development Commissioners may thereupon revoke or vary any such order.

Establishment of Forestry Fund.

8.—(1) The salaries of the Commissioners, and the salaries or remuneration of their officers and servants and all expenses incurred by the Commissioners in the exercise of their powers and the performance of duties under this Act, shall be defrayed out of a fund to be called the Forestry Fund.

(2) There shall be paid into the Forestry Fund—

(*a*) during the ten years immediately succeeding the first day of April, nineteen hundred and nineteen, the sum of three million five hundred thousand pounds in such annual amounts as Parliament may from time to time determine; and

(*b*) all sums received by the Commissioners in respect of the sale of any land or timber or otherwise received by the Commissioners in respect of any transactions carried out by them in the exercise of their powers and duties under this Act.

(3) The Commissioners may accept any gift made to them

for all or any of the purposes of this Act, and, subject to the terms thereof, may apply it for those purposes in accordance with regulations made by them. A.D. 1919.

(4) The Commissioners shall cause an account to be prepared and transmitted to the Comptroller and Auditor General for examination, on or before the thirtieth day of September in every year, showing the sums paid into and the sums issued out of the Forestry Fund in the financial year ending on the thirty-first day of March preceding, and the Comptroller and Auditor General shall certify and report on the same, and such account and report shall be laid before Parliament by the Commissioners on or before the thirty-first day of January in the following year if Pariament be then sitting, and, if Parliament be then not sitting, within one week after Parliament is next assembled.

The Commissioners shall also cause to be laid before both Houses of Parliament an annual report of their proceedings.

(5) Payments out of and into the Forestry Fund, and all other matters relating to the fund and money standing to the credit of the fund, shall be made and regulated in such manner as the Treasury may, by minute to be laid before Parliament, direct.

(6) The Treasury may from time to time invest any money, standing to the credit of the Forestry Fund in any securities in which trustees are by law authorised to invest trust funds.

Power of entry to inspect land, etc.

9. Any officer of the Commissioners or any other person authorised by them in that behalf, may on production, if so required, of his authority, enter on and survey any land for the purpose of ascertaining whether it is suitable for afforestation or for the purpose of inspecting any timber thereon, or for any other purpose in connexion with the exercise of the powers and performance of the duties of the Commissioners under this Act.

Pensions.

10.—(1) Where an officer appointed to the office of Forestry Commissioner with a salary holds at the time of his appointment an office in the civil service which entitles him to superannuation under the Superannuation Acts, 1834 to 1914, he shall be entitled on his ultimate retirement from the public service to the same allowances as if he had continued to hold the vacated appointment at the same rate of salary as when the same was vacated, subject nevertheless to the conditions

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which would in that case have been applicable with respect to the grant of such allowances:—

Provided that—

(*a*) it shall be lawful for the Treasury to grant such superannuation allowances to any such Forestry Commissioner on the expiration of his term of office without renewal of public employment; but any commissioner to whom such grant is made while under the age of sixty years shall be liable to be called upon to fill office under the Crown in the manner prescribed in section eleven of the Superannuation Act, 1859; and

22 Vict. c. 26.

(*b*) such part of any superannuation or other allowance or gratuity awarded by this section as the Treasury may determine shall be paid out of the Forestry Fund.

(2) The Forestry Commission may, with the approval of the Treasury, make schemes providing for the grant of superannuation and other allowances and gratuities to or for the benefit of such officers employed by them as may be from time to time approved by the Treasury, and may out of the Forestry Fund pay to such officers on retirement, or to their legal representatives on death, such superannuation and other allowances and gratuities under the schemes as the Treasury may sanction in each case; and the Treasury may determine the Forestry Fund to be a public fund for the purposes of the Superannuation Act, 1892.

55 & 56 Vict. c. 40.

Short title and commencement.

11.—(1) This Act may be cited as the Forestry Act, 1919.

(2) This Act shall come into operation on the first day of September, nineteen hundred and nineteen.

Section 7.

SCHEDULE.

(1) Where the Commissioners propose to purchase land compulsorily under this Act, they may submit to the Development Commissioners a draft order putting in force, as respects the lands specified in the order, the provisions of the Lands Clauses Acts with respect to the purchase and taking of land otherwise than by agreement.

(2) The order shall be in the prescribed form and shall contain such provisions as the Development Commissioners may prescribe for the purpose of carrying the order into effect, and shall incorporate the Lands Clauses Acts, except such of

8 & 9 Vict. c. 20.

those provisions as relate to the sale of superfluous land, and sections seventy-seven to eighty-five of the Railway Clauses Consolidation Act, 1845, or, in Scotland, sections seventy to seventy-eight of the Railway Clauses Consolidation (Scotland) Act, 1845, and those Acts shall apply accordingly. 8 & 9 Vict. c. 33.

(3) The draft order shall be published by the Commissioners in the prescribed manner, and such notice shall be given both in the locality in which the land proposed to be acquired is situate and to the owners, lessees, and occupiers of that land as may be prescribed, and in the case of land forming part of a common, open space, or allotment, also to the Board of Agriculture and Fisheries.

(4) An order authorising the acquisition of any buildings may, if portions only of those buildings are required for the purposes of the Commissioners, notwithstanding anything in the Lands Clauses Acts, require the owners of and other persons interested in those buildings to sell and convey to the Commissioners the portions only of the buildings so required, if the arbitrator is of opinion that such portions can be severed from the remainder of the properties without material detriment thereto, and, in such case, the Commissioners shall not be obliged to purchase the whole or any greater portion thereof, and shall pay for the portions acquired by them and make compensation for any damage sustained by the owners thereof or other parties interested therein by severance or otherwise.

(5) An order may provide for the continuance of any existing easement or the creation of any new easement over the land authorised to be acquired.

(6) Where the land is glebe land or other land belonging to an ecclesiastical benefice, the order shall provide that sums agreed upon or awarded for the purchase of the land or to be paid by way of compensation for the damage to be sustained by the owner by reason of severance or other injury affecting the land, shall not be paid as directed by the Lands Clauses Acts, but shall be paid to the Ecclesiastical Commissioners to be applied by them as money paid to them upon a sale under the provisions of the Ecclesiastical Leasing Acts of land belonging to a benefice.

The provisions of this paragraph shall not apply to Scotland or Ireland.

(7) In construing, for the purposes of this Schedule or any

A.D. 1919.

order made thereunder, any enactment incorporated with the order, this Act together with the order shall be deemed to be the special Act and the Commissioners shall be deemed to be the promoters of the undertaking, and the expression "land" shall include easements, in or relating to land.

(8) In this Schedule the expression "prescribed" means prescribed by the Development Commissioners, and in Scotland the expression "easements" means servitudes.

3. Forestry Exhibition in the Showyard of the Highland and Agricultural Society, held at Edinburgh, 8th to 11th July 1919.

This exhibition differed from those held in pre-war days in that it was non-competitive. It was considered that the time was not opportune for this class of exhibition, interesting and stimulating as it has proved to be under normal conditions. It is perhaps, however, not quite accurate to say that the element of competition was lacking, at least if one takes into consideration the main object which this exhibition was intended to demonstrate, that is, the relative merits of home-grown and foreign-grown timber. In other words the competition this year was not between individuals but between this country and other timber-producing lands.

The bulk of the exhibits consisted of a large collection of timber specimens which were brought together by the Timber Supply Department of the Board of Trade from various parts of Scotland, where timber exploitation was carried on in connection with the war. It was generally admitted that it was one of the best object-lessons of the kind which had as yet been brought before the public. The specimens were not specially selected for the purpose, but were average samples of what had been supplied to the army, the railways and the collieries, and they, therefore, gave a much better idea of the capabilities of the Scottish soil and climate for timber production than if they had been from specially selected trees.

Striking evidence was afforded of the decided superiority of our home-grown broad-leaved timber to the foreign product. Where it was possible to compare home and foreign timber, as was the case with the squares of home and foreign oak flooring,

which were shown side by side for the purpose, the difference was very marked in favour of the home product. The only respect in which the foreign timber is superior to the home-grown is in its straightness and the greater length of scantling which can be got from it, but this is due to scientific treatment and not to any advantage in soil or climate.

In the coniferous timber section many fine samples were shown of Scots pine, larch, Douglas fir, and spruce, but some leeway has to be made up in the case of spruce lining boards. The home-grown article lacks the fineness and evenness of grain seen in spruce lining from the north of Europe. For many years the spruce has been very much neglected, and most of the home-grown spruce timber available has to be taken from much too open stands or from partially isolated trees; as a consequence, it is wider ringed and less free from knots than is generally the case with imported spruce. Further, no attention whatever has been given to selection of the type of tree or race from which our plantations have been formed.

Few conifers, if any, vary so much as the spruce, and undoubted biological races exist with varying qualities as timber producers. With a careful selection of the proper type, and its allocation to areas where suitable conditions for its growth exist, spruce timber of a cleanness and quality of grain equal to the imported timber of this species can be grown in this country. Isolated cases are known in which home-grown spruce timber has been graded as first-class quality.

The scantlings and manufactured articles of Scots pine clearly showed that home-grown timber of this tree can hold its own with the finest products of the Continent.

Another interesting exhibit which further illustrated the superiority of home-grown hardwoods was one of tool handles, etc., of ash, oak and elm from the Galashiels district. Nothing better than the tool handles of ash, either in quality or workmanship, could be produced anywhere, and such handles, if the cost is not too great, should do much to supplant the American hickory handles which are so largely imported.

Of the larger specimens, there were many samples of scantlings of various sizes of both hardwood and coniferous timbers, which attracted great interest, including a full complement of oak scantlings for a railway waggon frame, which was laid out in front of the pavilion. There were also samples of railway

and tramway sleepers, stobs, pit-props, and other pit timbers, and several manufactured articles of the larger kind and also some samples of fancy hardwoods.

Among other exhibits was one of some nice clean pieces of wood turnery from the Fechney Boys' Industrial School, Perth, and various articles from the Lord Roberts Memorial workshops. Interesting and high-class samples of home-grown timber, which were sent in by timber merchants and others, were also on view. The extraordinary rapid growth of *Populus trichocarpa* was shown by two poles, cut in sections, from the Minto Estate, which were respectively 7 and 14 years old.

The kind of specimens exhibited by the Timber Supply Department of the Board of Trade is shown in the following summarised lists:—

List No. 1 was devoted to converted timber, and contained specimens of planks, sleepers, box boarding, waggon bottoming, pit timbers, fencing rails and stobs, keel blocks, tool and implement shafts, etc., and scantlings of various sizes, suitable for hutting and house building purposes, in coniferous and hardwood timbers.

List No. 2 contained specimens of pith planks from the root or first cut of various coniferous and hardwood trees.

List No. 3 was made up of specimens showing the various stages and the methods adopted in the conversion of logs and tops into scantlings and articles of use in the employment of timber.

In this way the staging of the exhibit showed, by means of actual samples, the various uses to which logs and tops can be put, and how practically every requirement for timber had been met, and can be met in future, from home-grown timbers, if the supplies are augmented and maintained.

List No. 4, headed Cross sections of logs, embraced a large number of specimens, in which the transverse section of the root cut of various coniferous and hardwood trees was exhibited to show the quality of growth, year ring, and heart and sap wood.

List No. 5 was made up of specimens to show the same features, but in radial and tangential view.

List No. 6 was composed of specimens exhibiting special features, such as the bad results of leaving dead snags and broken branches on the tree, bad effect of careless pruning, occlusion of branches, etc.

List No. 7 was made up of various samples showing timber in the converted and unconverted state.

As already stated, samples were also staged in the pavilion showing some of the ornamental features of home-grown woods, such as oak, ash, elm and sycamore burr, walnut, plane and oak curl, veneers, etc.

It is unnecessary to detail the full list of samples displayed, nor was it possible to bring together in this exhibition a complete series of specimens to show all the uses to which home-grown timber has been and can be put.

In addition to the above there was a fine set of photographs, sent by Colonel Sutherland, which showed Army timber operations in France which were carried out under the direction of Brigadier-General Lord Lovat. These were taken in the Basse Forêt d'Eu, the Forêt d'Eaury, the Forêt de Lyons, the Haute Forêt d'Eu, and the Brotonne Forest. The photographic section proper is discussed in the article which follows.

A large map was also on view which showed the locations of the various timber corps—American, Australian, Canadian and Newfoundland—which were operating in Scotland during the war.

The pavilion in which the collection was housed was formed from some of the huts which had been used in the forest by the Canadian Forestry Corps.

The exhibition entirely fulfilled its function, in that it showed that the kind and quality of timber principally required by our great wood-consuming industries can be grown in this country.

The Society's pavilion was crowded by visitors during the four days of the show, and the numerous questions asked by visitors and the keen interest aroused by the various exhibits were an unmistakable sign that the importance of forestry, and all it means, to the country in times of peace and war, is now taking a firmer hold on the public mind. X.

Photographic Section.

In this section nineteen 53-inch by 38-inch and forty-seven 24-inch by 18-inch enlargements were exhibited. They were selected from a large set which has been taken in conjunction with the Forest Statistical Survey of Scotland. Forestry owes one more debt to Sir John Stirling-Maxwell for having initiated and carried through, at his own expense,

this photographic survey. The photographs were taken by Mr Walter Bell, and the subjects were selected by the Statistical officers.

The camera has an important and well-defined place in the future development of forestry. Much experimental work will have to be done in connection with the establishment and the development of forestry in this country. This work, however, will be in vain unless it is made available to, and utilised by, those engaged in this industry. Photography will be of great value as one of the means of incorporating the results of experiments and research with existing practice. For instance, photographs can be used to illustrate improved methods in nursery and saw-milling practice, to show the relative rates of growth of different species under various conditions, to illustrate the various methods of natural regeneration, and in many other ways. The value of the systematic use of photography in forestry is being recognised in other countries, *e.g.* America, where an intensive use of the camera is to be made in connection with the Forest Statistical Survey in that country. It is good to know that we have not waited for other countries to show the way in this matter, as the photographs exhibited and this brief description show.

The photographs were classified as follows:—

1. *Photographs illustrating stands of Mature Timber.*

As is well known a large proportion of the mature timber in this country was cut for war purposes. Both on general and technical grounds it would have been a misfortune if these woods had disappeared without any records being left of them. In many cases, however, complete technical statistics and photographs were obtained before their demolition. The photographs exhibited in this group were intended to illustrate some of the more notable of these woods. The Scots pine exhibits included a photograph of a sample plot at Langlee, Jedburgh—elevation above sea-level, 500 feet; age of wood, 124 years; mean height, 90 feet; volume, quarter girth, under bark, 8600 cub. feet. Another photograph illustrated a portion of the Orton Wood, Elginshire. This portion was a mixture of Scots pine and larch — elevation, 300 feet; age, 125 years; mean height, about 90 feet. A third photograph showed natural Scots pine in Glen More Forest, Inverness-shire, at an elevation of

1000 to 1250 feet above sea-level. The larch photographs included two from a series taken at Dunkeld in conjunction with a set of sample plots to show the effect of elevation. One was on Birnam Hill, Murthly Estate—elevation, 350 feet; age, 79 years; mean height, 88 feet; volume, quarter-girth, under bark, 5315 cub. feet. Another on Craigvinean, Atholl Estate —elevation, 1400 feet; age, 86 years; mean height, 60 feet; volume, quarter-girth, under bark, 1695 cub. feet. Another set showed the growth of larch on the West Coast. They included photographs of a sample plot at Braemore, Ross-shire —elevation, 700 feet; age, 50 years; mean height, 70 feet; volume, quarter-girth, under bark, 4470 cub. feet; and of a sample plot on the Glengarry Estate, Inverness-shire—elevation, 500 feet; age, 60 years; mean height, 83 feet; volume, quarter-girth, under bark, 4890 cub. feet.

2. *Photographs illustrating stands of Pit-wood.*

In this group were a series of photographs illustrating stands of pit-wood which have been cut, and also stands which are still growing. In the first category was a Scots pine sample plot at Knockando, Ballindalloch Estate — elevation, 650 feet; age, 51 years; mean height, 48 feet; volume, quarter-girth, under bark, 3905 cub. feet; and a larch sample plot on the Corriegour Estate, Inverness-shire — elevation, 900 feet; age, 39 years; mean height, 50 feet; volume, quarter-girth, under bark, 3285 cub. feet. The second category included photographs of a Scots pine sample plot on the Strathspey Estate, Seafield property—elevation, 750 feet; age, 59 years; mean height, 55 feet; volume, quarter-girth, under bark, 4585 cub. feet: a larch sample plot on the Kilkerran Estate, Ayrshire—elevation, 350 feet; age, 30 years; mean height, 48 feet; volume, quarter-girth, under bark, 2095 cub. feet; and a spruce sample plot on the Keir Estate, Perthshire —elevation, 250 feet; age, 36 years; mean height, 60 feet; volume, quarter-girth, under bark, 4510 cub. feet.

3. *Photographs illustrating the growth of Young Plantations.*

This group contained a very interesting set of photographs showing the natural regeneration of Scots pine and of larch, both pure and mixed together on the Strathspey Estate, *e.g.* there was a photograph showing a very complete growth of natural

Scots pine before the renewal of seed trees. This was on heather ground grazed by sheep at Boat of Garten. Others showed a dense crop of natural larch on Tominourd Hill, and a natural mixture of Scots pine and larch on the same hill. The larch regenerated first, then the Scots pine filled in the gaps naturally.

Another set showed the comparative growth of various species on the Glengarry Estate, Inverness-shire. They were of test plantations, planted after the Glen Mhor Survey, and therefore of special interest to members of the Society. The age of the plantations were from 8 to 10 years, and the species were larch, Corsican pine, Douglas fir, and Sitka spruce.

4. *Photographs illustrating Timber Operations.*

In this group were a series of photographs illustrating the work of the Canadian and Newfoundland Forestry Corps in this country. The Canadian Forestry Corps photographs included a view of the camp at Nethy Bridge; a log bridge at Birkenside, Jedburgh; a light railway through the Sluggan Pass, Inverness-shire; and a cableway over the Spey at Knockando. The Newfoundland set included views of the camp at Craigvinean, Dunkeld, and of the timber chute there.

5. *General.*

There were very interesting photographs of young Douglas fir at Ringwood, Murthly, Perthshire, and old Douglas fir also at Murthly. Two photographs were exhibited showing the growth of Sitka spruce, one at Craigo, Forfarshire, and the other in British Columbia.

The great interest shown in this section clearly showed the possibilities which systematic photography has in forestry education.

H. M. Steven.

4. Forestry Considered as a Key Industry.

(*With Plate.*)

By James Fraser.

The British Science and Key Industries Exhibition held at Kelvin Hall, Glasgow, from Nov. 17 to Dec. 6 1919, gave to the Society an opportunity to put in active operation a line of policy which it now realises to be essential. The exhibitions of the past have too often been directed in such a manner that they appealed to those who were already interested in forestry matters; they had therefore a comparatively narrow sphere of influence. It is not to be inferred that the Society neglected the important duty of endeavouring to influence public feeling, but rather that it now intends to show how the questions dealing with afforestation must be understood by the whole nation. If the result of such endeavours is only, in the first place, to arouse additional criticism, a certain measure of success will have been obtained. Active opposition is much to be preferred to cold indifference, and it may be safely assumed that if a critic wishes to make any real active opposition he will always make it his business to study the matter carefully. The afforestation schemes that have been adopted in recent years in various countries show that, while in every country certain broad resemblances exist in these schemes, there are well-defined problems peculiar to the special circumstances of each. In Britain our main efforts must be directed to show that the creation of forests is essential for the most economic use of our productive powers. It must be shown that timber of value can be produced and that the land used for the production of the timber is under a form of cultivation that ensures the maximum possible permanent value to the country. When the value of the return is estimated it is not sufficient to show that trees grown in a certain manner give a certain return in timber and money value. It is an opinion frequently implied, if not openly expressed, that the greater profit in money value is obtained by the person who buys and markets the crop. Such an attitude can only be assumed by people who are unwilling to go to the same trouble as the buyer of the timber in the marketing of their produce. Further, it must be remembered that the money return of a forest area, in order

that it may express a real value, must include a financial assessment of indirect advantages to the nation. In other words, the value assigned to the forest must be that derived by the nation, and estimates of value to individual owners can at the best express only a part of the value of land used in timber production.

The possibilities of the country as a timber-producing area were well demonstrated by the exhibit of specimens of practically every species growing in Scotland. That the planks exhibited were not a few selected specimens out of many could well be shown by a very cursory examination of the photographs showing types of Scottish woodlands. Those who were most ready to make a remark of that kind were also ready to express admiration for the woods shown in the prints lent to the Society by Sir John Stirling-Maxwell The exhibits of planks and photographs showed in a most definite manner to the general public the productive powers of our country. These two collections alone would have done much to educate visitors to the stand. The general arrangement of material was of such a nature that almost any visitor could answer for himself any question that might occur to him while examining any one collection. Examination of planks may show to an interested person that wood of a workable quality can be grown, and the question naturally arises, For what can the wood be used? Those in charge of the selection did well to include in their exhibits examples of turned work in such woods as horse chestnut, poplar, birch. At a time when endeavours are made to improve the wage-earning capacities of rural workers and to obtain the highest returns from woodlands of all classes, it is somewhat strange to find that the question of development of manufacture of small woodware has received so little attention. The articles shown among the collection were, without doubt, chosen with a view to indicating what can be done. It may be suggested that the addition of a small collection of a more varied nature might be useful in future exhibitions, and that it should include specimens of the articles at all stages of manufacture.

The comparison of home-grown timber with imported timber was well provided for. In a centre of timber users such as Glasgow the material shown for this purpose excited no small amount of attention. The most unkind remark that could be

[*Photograph by Dun Engraving Co., Exhibition Official Photographers.*

EXHIBITION STAND OF ROYAL SCOTTISH ARBORICULTURAL SOCIETY.
KEY INDUSTRIES EXHIBITION, GLASGOW (November 1919).

[*To face p.* 33.

made by any fair-minded visitor would be, "The country cannot supply a continuous demand." The material provided for the comparison included specimens of flooring, weather boarding, and linings of Scots pine, spruce, larch, and the quality of the home products as compared with imported could be easily demonstrated. It was not possible to show in an exhibition stand all the uses that home timber may be put to, but it is intended that in future exhibitions greater prominence should be given to methods devised to show the range of uses. Two planks that may be specially mentioned as objects of special interest were those of *Sequoia gigantea* and of cherry.

The value of photographs referred to above was not limited to showing only the type of wood that may be grown in Scotland; the descriptions accompanying these included estimates of volumes, and stated the ages. The selection of subjects included woods of the species that have been found most profitable in Scotland. A short examination of the yields per acre will at once cause an enquiry into the probable money yields when difference of market price of timber is balanced by greater yield per unit of area. An impartial observer might have some difficulty in finding why spruce, for example, has not been more widely used in Scotland for afforestation.

A special example may be given of the care taken to ensure that the articles shown should not be merely a collection of isolated objects of interest. Messrs Whytock & Reid of Edinburgh kindly lent for exhibition some fine examples of furniture of Scottish-grown oak. Apart from the lesson in workmanship to be learned, the interest lay in the careful selection of figured oak and in the prepared sections of burr elm. The method by which the figure was obtained was shown by exhibition of oak planks cut to show figures; the nature of the elm burr was also shown on a specially prepared section of a burr.

One of the special duties of a forest service in Britain must be that of creating the forest area. Although the length of rotation necessary for forests is vaguely known to all people, few of the general public appreciate the care and expense necessary for the management of forest nurseries. One of our greatest expenses in early stages of afforestation in Scotland will be that of protecting our trees against rabbits. If once the general public can realise that the forest is a national property and that it is entitled to the protection of the laws of the country,

it will insist that the expense of such protection should be paid by the parties who make such protection necessary. It is not to be desired that the State should interfere unduly with the rights of private owners, but it is certain that no individual should be allowed to conduct the management of his affairs in such a way that the property of the nation suffers. If once the position with regard to State property is defined it should be simple to extend the principle to relations between individuals. In this connection the exhibits of young forest trees, showing the injury caused by rabbits, were of great value. Young trees were obtained by Mr Whitton, and arranged by him to show stages from one to five years. When it is appreciated by the public how much depends on the care given to the young plantations and how much of their money must be paid in the rearing of plants, a further advance will have been made. At present, young plantations are too often regarded as rather pleasant features in the landscape; their value is only remotely appreciated.

There were included also in the exhibits, objects of more special interest, such as sections prepared to show the most economical conversion of timber. The prepared samples of mining timber should reinforce the lessons learned during the war as to the necessity of converting every part of timber that can find a market. It is rather unfortunate, however, that very often the deciding factor must be the cost of transport. It can not be argued that special consideration should be given to certain forms of industry unless it can be shown at the same time that the nation as a whole benefits. The question is one that involves the consideration of the use of small timber generally. It is not necessary that special treatment of any kind should be given to the proposed national industry. Those who have given thought to the position are certain that the industry is an economically sound one, and it is their duty to show the nation that the matter is one that is of national importance.

A mere list of all the objects shown would give but a feeble impression of the aims of the Society in sending the collection to Glasgow. The purpose was mainly to stimulate public interest in an industry which directly affects the prosperity of the country. The appeal to public interest was made, not by a mass of isolated interesting specimens but by a carefully

arranged and reasoned argument. The interest aroused exceeded the hopes of the most hopeful.

The Society is deeply indebted to the many contributors of valuable specimens. The success is mainly due to those contributors, and to the efforts of Mr Machison and Mr Whitton to make the best possible use of material supplied.

5. Conference on the subject of the Grading, Seasoning, and Utilisation of Home-Grown Timber, held in the Christian Institute, Bothwell Street, Glasgow, on Wednesday, 6th August, at 2 p.m.

In opening the proceedings, Sir John Stirling-Maxwell, who was in the chair, said :—"Gentlemen, I have to thank you very much for coming in such large numbers in response to the invitation we ventured to send to you. This meeting, I think, is perhaps as representative a gathering as has ever assembled in Scotland to consider the question of the use of home-grown timber. We have here, besides a large representation of Timber Merchants, both official and individual, representatives of Architects, Surveyors, Railway Companies, the Office of Works, the Ministry of Health, the Department of Building Materials, the Interim Forest Authority, and other bodies interested in the subject. I will explain as briefly as I can what caused us to ask you to come together. Let me say at once that neither I nor those who have been working with me in the Timber Supply Department flatter ourselves that we are in a position to teach timber merchants or anyone else their business. We have been compelled by the work we have been doing during the last two or three years to take a bird's-eye view of the situation, and it is owing to our observations in that respect that we have asked you to come together. For the first time the question of timber growing in this country has become a subject of fairly wide interest. Many people regard it chiefly from the point of view of rural development, a matter in which our country is strangely behind most countries of the world. That does not concern us to-day. We are concerned with the practical side of the business, and that is the use of home-grown timber and the creation of a trade—a profitable trade—in the manufacture of home-grown timber. Now let me say in passing that I hope

that, although it appears that the Government in future are going to take a very large part in the planting of wood in this country, the example of France will be followed, and that these woods will be exploited by the timber trade. It is the business of the State in that country to keep a very strict hold upon the sales, but the conversion of the wood lies entirely with the trade. It is the wisest course, and I should like to say that nothing in my experience in the Timber Supply Department leads me to believe the Government would be the best agent for the manufacture of timber.

"Passing from that, the whole question we are considering ultimately depends upon how far home-grown timber really is required. Various views are expressed on the question of our national supplies. The Government appears to have taken the view at last that these supplies are precarious—our supplies from abroad—and that some steps must be taken to supplement them at home. I mention this subject because the whole question of home-grown timber is apt to be prejudiced by very loose statements that are made from time to time as to the supplies of timber which the world possesses. These supplies are very large when you can fasten your attention on the untouched woods, but they become very inadequate when you look a little farther into the history of the world's woods and the rate at which they are being exploited. At this moment I would have thought it was almost enough to bear in mind that up to the time of the war this country was drawing half of its whole supplies of imported timber from one country—Russia—and to point to the state of that country at the present moment.

"But I think perhaps the condition of things would be better brought home to one by the experience of some other countries. Take, for instance, the United States of America. The United States, with a very large area of woods, has been for many years in great anxiety about its timber supplies, and it has taken the trouble, which this country has never taken, to find out what supplies the world contains. The woods of the United States have been reduced from what was reckoned to be 8,000,000,000 acres, when the country was first settled by white men, down to about 5,000,000,000 acres. Meanwhile the consumption of wood in the United States has risen to the extraordinary figure of 260 cubic feet per head per annum, largely due to the fact that the people live in wooden houses, a fact which every

American thinks the foundation of his country's development. The result is that the woods of the United States, vast as they seem, are not vast enough now for their own requirements, and the annual cutting of the woods is reckoned to be three times the annual growth. Of course in North America there is also destruction by fire. I believe that fire consumes seven to ten times as much timber as falls to the lumbermen's axe. You may therefore write off America altogether as a source of supply.

"In Canada things have not yet got to the same point, but they must come to it. The supplies of Russia, which we were accustomed to think limitless, are, after all, not much more than those of Canada and the United States added together, and they are still of more uncertain quality. Though I have heard many people say that the woods of Russia can never be exhausted, I have never heard reliable evidence as to the area and composition of these woods. A Russian official told me that the woods have not yet been surveyed, and that vast tracts consist of swamps or thin birchwood, or have been devastated. Though there are very large reserves in North Russia, they cannot carry on the world for very many years. The point is that it takes seventy-five years to prepare against a timber famine, and therefore anything that has to be done should be done in good time.

"I have ventured on this preliminary disquisition because, as I say, the whole subject is so often prejudiced by a belief utterly unfounded, that if we can get imports we can get all the timber we require. It is not the case. I believe the Russian Bolshevist has in his hands, if he likes to use it, an extraordinary weapon against the rest of the world by withholding supplies of timber.

"Now to come to the position of home-grown timber in this country, the best timber that we grow here, and I am only now speaking of the best, has never had a fair chance in our market. Taking it over the whole, you may say that home-grown timber has been considered the refuse of the market. I know our best timber has very often been put to good use, but it has gone to supplement supplies of timber brought from abroad, and those who have used it have not known whether it was grown in this country or not, whereas all the inferior material which is used for temporary work is known to be home-grown timber, and it

is only in that form that the product of the country is known to the public at large at all. Before the war it was a melancholy fact that a sleeper of home-grown wood, though it might be of equal quality to an imported sleeper, was worth very much less money. The difference of price depended on two things—the prejudice of the buyer and want of organisation amongst the producers. I happened to have something to do with that matter, both from the point of view of a railway company and from the point of view of a group of people who were trying to produce sleepers. I found from the point of view of the railway company that they could not get a guarantee of sufficient supplies to justify them entering into large contracts at the same prices as they were paying for imported wood; from the other point of view, that they could not make any arrangement. The price of home sleepers was 1s. less than the price being paid for sleepers from abroad. We have got to put these things right. The war has not rectified them, although it has led to the use of an immense amount of home-grown timber. In some ways it has emphasised the difficulties of the situation and the stigma under which home timber has lain. The work has been hurried. Producers have been pressed to put in the largest amount of stuff to meet urgent needs without being too particular, and the exploitation has also been by the Government direct, and that also has been done in extreme haste. This may have led to mistaken notions as to the quality of timber which can be produced under normal conditions. For instance, I read in yesterday's newspaper that Mr M'Laren, M.P., had made a speech in the House of Commons in which he stated that pit-wood produced in Scotland could not be used in a mine because it let the roof down. I hope someone will answer him. I am sure he did not wish to do harm, but spoke because he was ill-informed, and mistakes of that kind are much too common.

"How are we to put things right? I think we have a great opportunity during the next two or three years. Supplies of timber from the Baltic and elsewhere and from British Columbia have been coming in. They have not been coming in in large quantities, and freights are certain to be very expensive for some time. There will also be great competition for coniferous timber from other countries, and, therefore, I feel that those who are going to be users of timber, and especially Government

Departments, would not only be justified but really are bound to insure themselves against shortage of supplies from abroad. I feel that they are in a position when they can and ought to make contracts on a large scale covering a period of years until things return to normal. That is an important point. Of course, it is no good my saying to timber merchants or anyone else that they ought to be doing more justice to the timber, unless they are sure of a market at the end. I need not mention the technical side, because it is so familiar. But home-grown timber will never have its proper place in the market until it is properly graded and seasoned and takes its place so that it can actually be compared with imported. That must be done, but, of course, it entails considerable expense, and it is a gamble, and no one will enter into it unless he sees a market for his wood. By entering it now he would run the risk of being swamped by a large importation from abroad, which would leave the timber merchant with his stuff as a drug on the market. That has to be avoided. I think we are in a position now when arrangements ought to be made with the trade and users which would bridge over this difficulty and put home-grown timber in its proper position. Of course there are difficulties, and one sees that this cannot be done without a fairly close alliance between the home-grown timber trade and the importing timber merchants, because while one side handles the timber, the other side has the mills and machinery which are required for putting it in order for building and other purposes. An alliance of that kind might be very much to the advantage of both parties. I say nothing about that because it is not my business.

"I hope the opportunity of this Conference will be taken for the various bodies represented here to tell us and tell each other what the actual difficulties are to putting a scheme of that kind into practice. I may say that I had a letter from Sir James Ball, who was until recently Timber Controller. He was very sorry to be unable to be here because he was unwell. He wrote very sympathetically about the work we were doing. He is a man who came into this business quite unprejudiced—he came as a railway engineer. He often told me how, before the war, he had made up his mind, from actual experience and trials, that he could get out of our Scots pine in this country sleepers quite as good as imported from the Gulf or anywhere

else. He tried very hard to get supplies of sleepers in this country. Prices went from 3s. 6d. to 4s. 6d. and so on, sometimes higher. He was unable to get supplies because there was no organisation which could promise him supplies, and he gave the thing up as hopeless. He was quite prepared to give the then ruling price for home-grown sleepers.

"If you could form amongst you any organisation to place contracts and carry them through, there is no question that the whole difficulty of using home-grown timber would be solved once for all.

"In other countries, France and Germany for instance, a very large proportion of the timber is now imported, and the only difference is that they start from the basis of their own timber, and the imported timber comes in to supplement it. In our case we have to invert the process."

Mr Donald Munro (North of Scotland Home Timber Merchants' Association) said:—"I think the reason why home timber has not been used and properly graded in the past is because we had really no guarantee that it would be used. As Sir John pointed out, it was a gamble. During the war we have all had experience of what home timber has done, and, as Sir John pointed out, if it was properly graded in the future, it should be used for the various housing schemes before the country at present. I think that what might be done in the home timber trade is that the merchants should manufacture their timber into various sizes of scantlings, that it be stamped with their name, sent into a central yard where an expert could be employed to grade it, a standard rate being fixed for it, and sold from that central yard to the building trade.

"In connection with the question of sleepers, I may say that we had a meeting to-day, and we have practically an offer—a suggested offer—from the Railway Executive for a contract for all the sleeper production for the next two years. We had a conference in London ten days ago with Sir James Ball, who has now been appointed Chairman of the Timber Purchasing Committee, and they, I understand, are prepared to buy all the home sleepers for the next two years at a price—not quite the price paid for foreign sleepers—but a satisfactory price."

Mr J. R. Watson (Builder and Contractor, Edinburgh) said:—"I am not interested very much in the hardwoods, and therefore confine my remarks to the softwoods, and, as a

preliminary, I should like to say there should be some steps taken to prevent confusion in the names. In the Timber Control Order there are larch, Scots pine, Douglas fir and spruce mentioned. In the War Office schedule you will find that they speak of fir and white fir. I was a little confused about this timber. I asked a timber merchant about it, but either his explanation was too vague or I was a little bit dull, but I was not much wiser. I think, therefore, to prevent mistakes at the outset, there should be some regular system of naming the timber so that when the architect specifies what he wants, the contractor can supply it. That seems to me a necessary preliminary.

"So far as my experience of softwoods has gone, I do not see any reason why they should not be used for all the purposes for which foreign timber has been used. We have handled a considerable quantity of it, and it is quite as good as the foreign article, that is to say if it has been properly taken care of. For flooring and things of that kind it is equal to imported timber. The timber should be cut down at the proper time. It has, of course, to be properly manufactured—equal to the standard of imported timber. That should not present much difficulty. The timber would require to be carefully seasoned and stored—not necessarily seasoned for use. It should be kept in proper condition, and it will not deteriorate but rather improve.

"In connection with the timber we have received delivery of recently, we occasionally saw deals and planks produced in 15-feet or 16-feet lengths with scarcely a knot in them—much better than the imported article—absolutely free from defects, at least knots. Luggage trunks and box beds were made of home timber, and it seems to me that a revival of that industry would be an outlet for home-grown timber. If the timber were properly taken care of and properly graded, and these good trees selected out of material suitable for that purpose and manufactured, I think we might do very much worse than encourage such an industry in this country."

Mr M'Nab (Architect) said:—"If the architect knew what timber was available for various purposes, I do not think the profession would scruple to make use of it. The difficulty was whether the timber was available in a seasoned condition."

Sir Robert Lorimer, F.R.I.B.A., said:—"I entirely agree with what the last speaker says and also with Mr Watson. The

difficulty always has been to get a continuous supply of Scots timber. One can get it in small quantities, but one can never get a continuous supply of either softwoods or hardwoods. The point Mr Watson raised about the confusion in names is a very important one, and I think that if Scots timber was put on the market in a business-like way the confusion in regard to the names would be cleared up. We really ought to know what we are getting, and I think if some tests could be introduced which would prove which of these timbers is really the best for the purpose, it would be of great assistance. Another point is that home timber could not be got in long lengths. My experience in the use of Scots timber is principally for interior work, and I have been interested in the question of Scots timber since I started business. In connection with the Thistle Chapel at St Giles I tried to get Scots oak. I found there was not a sufficient quantity of Scots oak seasoned, and I had to use English oak. The position is different now. I find that many contractors have become greatly interested in the subject, and a number of them have laid down very considerable stocks. I know several contractors who have large stocks of Scots oak because they now see the great beauty of it. For interior work there is absolutely no comparison between Scots oak and Austrian oak. In order to prove that I try to practise what I preach, I may say that I have recently restored a house for a Glasgow gentleman, Mr W. S. Miller. It was a house of the year 1600, and we had to gut it completely. I thought now here is a typical Scots house, we ought to use Scots wood. I used Scots oak for the floors throughout the entire house, and not in 3-inch widths but good wide boards varying from 8 inches to 11 inches. I have no doubt many will say such flooring will never stand, but such floors will stand perfectly well if you get the stuff properly seasoned and employ men who know how to handle it. If you get the right stuff, floors made of wide flooring of Scots oak will stand very well, and regarding appearance there is nothing to touch it. In the servants' wing I used larch, and Scots larch is most excellent. Regarding the finishing of the various rooms, I used the following woods. I panelled several rooms in Scots oak, two rooms in Scots pine, one room in larch, one in elm, one in ash, two in plane tree, one in beech, and one in Scots walnut. A number of Scots woods are perfectly adaptable to panelling and finish to the very

best class of work, and it has only to be known how attractive these woods are. All that is wanted really is that it should be possible to get a supply put on the market graded and seasoned so that when an architect specifies these woods he can get them. At present we can only get them in small quantities. Scots walnut is very difficult to get, and it makes a most beautiful room. I see no reason why Scots walnut should not be grown. Another wood is wild cherry or gean. That makes beautiful furniture and panellings. In Scotland it grows to a large size. I am certain that all these woods could be more largely used if people only realised how beautiful and how well adapted they are. Elm and larch make most beautiful veneers. Scots oak, yew tree, laburnum and quite a number of other species are adapted to the very finest class of cabinet work.

"Speaking as an architect, I think there is a great future before Scots timber if it can only be put on the market in such a condition that architects can utilise it."

Mr Dansken (Surveyor) said:—"As the representative of the Western Institute of the Faculty of Surveyors, it gives me great pleasure to associate myself with the remarks that have been made regarding home-grown timber. We surveyors very often take our instructions regarding specifications from the architects, but I feel sure when a new industry like this can be promoted it will be welcomed by all classes of the community who have the interest of the country at heart. I can say as a surveyor that we shall be only too glad to specify home-grown timber whenever we can get the opportunity."

Mr Smith (Edinburgh Council of Surveyors) said:—"I can only corroborate what the previous speaker has said. There is one matter I might mention to the Timber Merchants' Association. When they prepare their standard lengths they should not make them too numerous. I am asking that specially for the surveyors. You can easily imagine in a big job that the surveyor's work is increased very much by too many lengths. We would only be too pleased to specify Scots woods."

Mr Benzie (G.N.S. Railway Company) said:—"We have used and hope to continue to use home sleepers. We are just as satisfied with the home sleepers as with foreign sleepers. My company, so far as I know, has only used one small consignment of imported sleepers. Otherwise it has used

Scots pine, larch, and spruce, and was quite satisfied with them all."

Mr Ryle (Office of Works) said:—"The Office of Works have used a considerable amount of English oak. We had to use it for the roof of Glasgow Cathedral as we could not get Scots oak. I think the immediate problem is, How are we to get hold of home-grown softwoods for our buildings, and how are we to specify, and how are we to get what we specify? Taking carpentry work, we are using much home timber to-day, and it is quite suitable for ordinary carpentry work provided it is put in a situation to which air will get free access. Houses must be thoroughly ventilated, otherwise we shall have trouble with dry rot."

Sir John Stirling-Maxwell.—"That applies also to imported timber."

Mr Ryle.—"Not to the same extent."

Sir John Stirling-Maxwell.—"That is because it is seasoned."

Mr Ryle.—"Yes. The timber trade should arrange to confer with the architects and the building trade as to the standards of quality, that is, a standard grading as regards methods of conversion, and also as to a standard of sizes. In connection with the building trade, we have been endeavouring for the last four years to standardise our specification so that we might all know what we are talking about when we mention a particular subject. The architect should have a proper specification for each quality of timber, and should be able to know that he will get the quality of timber for which he specified. One way would be for the timber merchant to deposit samples with the various architectural institutes all over the country. Architects could go and see these samples, and see what was represented by the specification. The architect would always use only home-grown timber if he was sure he could get timber that would be suitable for the work. I think this difficulty is simply due to very unscientific selection at the present moment. As a practical point the first thing to do is for the timber trades to confer with the architects and the builders and the surveyors on these points, and to arrive at a definite classification of timber for building-trade purposes."

Mr Paterson (Ministry of Health) said:—"I may say that the Scottish Board of Health has no prejudice against the use of home-grown timber, but they have to guard against any

unnecessary expense, and, of course, there would be unnecessary expense if wood is not properly seasoned. I think we can guarantee that home-grown timber properly graded and seasoned, if available, will be used. What Mr Ryle says can be taken for the Board of Health if suitable home timber can be offered."

Mr Button (Building Materials Department) said:—"I may say that the subject of Scottish home-grown timber is at present receiving the consideration of our Board, and the actual amount will be governed by the extent to which architects will use it. One gentleman raised the question of sizes and stocks. If that information were placed at the disposal of the architects it would be an advantage."

Sir John Stirling-Maxwell.—"Of course it would really solve the question if users could say what they want—say they want so many thousand standards of timber during the next two years. Timber will never be produced except to a definite demand. If such a demand were made from your department or other departments interested, then these gentlemen of the timber trade would co-operate and give a collective guarantee."

Colonel W. Steuart Fothringham (Interim Forest Authority) said:—"The first thing that occurs to me as representing the Interim Forest Authority is that the Authority, as at present constituted, have not the slightest intention of interfering with the timber trade. That is the view that is taken by the present Interim Forest Authority, and if the permanent authority is constituted as is the present Interim Authority, they will have not the slightest wish to interfere with the timber trade at all. They will confine themselves to the growing of timber, and when the timber is grown it will be for the timber trade to make the best use they can of it. It seems to me the discussion is going in rather a vicious circle. Nobody seems to have given any indication of where the beginning is to be made. My own view is that if the Office of Works, or some similar big institution, who have the making out of schedules for contracts, would specify that home timber was to be used and would exercise a long view and say we shall want this timber in two or three years' time, this would give a fair start. Somebody must start, and I think the Office of Works might be the people who should make a start in this particular case. I do not think the timber trade is the least likely to cut timber into special

lengths unless a promise is given that these will be required. I do not think it can be expected that they should keep large stocks of timber without knowing how they are going to dispose of them.

"With regard to seasoning, there is probably a great deal to be learned in this country. We have not been in the habit of keeping timber for any length of time, and there are probably ways and means of seasoning it which we have yet to learn. I know from my own experience that before foreign timber was imported into this country the home-grown timber used in building lasted for a long time. There are many buildings where home timber was used a hundred years ago, in which it is perfectly sound and good to-day. There is no reason why the timber which is grown now or in the future should not be equally good. In those days there was no importation, and thus home-grown timber had to be used."

Colonel John D. Sutherland said:—"You reminded me, Sir John, in your address, of an interview that you said you had, I think in 1912, with the railway companies in Scotland. I remember the appeal you then made along with the other members of the special deputation to the railway companies, and I also remember that the result of your appeal was not very satisfactory, for the railway companies still continued to buy as much imported timber as ever. As a result of that meeting, we formed a small Inter-Departmental Committee in 1913. It was quite a private investigation, and we met in London, and just up to the time war broke out we had accumulated much useful information about the utility of home-grown timber. But the war came. I remember well in August 1914 the Board of Agriculture, which is accused of doing many things it ought not to have done and leaving undone what it might have done, convened a meeting—I think it was on 27th August of that year. The meeting consisted of mine-owners and some timber merchants and landowners. I had the honour of presiding at that meeting, and I asked the representative of the mine-owners to be good enough to let me know what he thought of the position in regard to timber, particularly mining timber, which we felt would become more and more necessary as the war went on. The representative of the coalmasters at once made the following two statements. He said, 'It is impossible, gentlemen, to get enough pit-wood for our mines in Scotland

from our home woods.' He said, 'We have been getting 80 per cent. of that timber from abroad in the past, and we will never get half enough from our home woods, and we will be bound to get it from abroad.' The next statement was as to quartering. 'You can never quarter home timber for pit-wood because it has not the strength of imported timber.' As to his first statement, in about two years, I think in 1917, the whole of the mines in Scotland were supplied with pit-wood—with Scottish pit-wood—and not only the Scottish mines but many English mines were supplied in addition. In so far as the statement concerning strength is concerned, he himself acknowledges now that he was absolutely mistaken, but it was the statement of prejudice, exactly the same prejudice which in 1912 influenced the railway companies when they were approached about sleepers.

"Now in 1915, that was the second year of the war, the Office of Works in London were then the department to supply timber to the War Office. Timber for the war was supplied through the Office of Works, and it occurred to me that we might push some native woods through the Office of Works and from there to France. I found a little prejudice there also, but the pressure on the War Office for supplies involved application from the Office of Works to Scotland to provide sleepers and other timber for France, and in that connection I would like to pay a tribute to the timber merchants of Scotland. It was my duty to go to them and ask for help, and they co-operated to a man. I do not think there was any better co-operation in the whole war than that of the Scots timber merchants in the supply of wood for France. I remember the original suggestion was that we might get 3/4000 defence poles, and we convened the Scots timber merchants together. They said they would supply 4000 poles at once, and they were ordered. At the end of about a month, instead of 4000 mining poles, we had a stock of 14,000 or 15,000, and they were at once despatched to France. But when I told London that instead of 4000 mining poles we had 14,000 or 15,000 they said we had overstepped our authority. But we had confidence in Scotland in these days, with the result that these 10,000 additional pieces of timber went over to France, and the supply was kept abreast of the demand for two years. I saw one of the engineers very shortly

afterwards, who had come over from France, and he said that the poles which came from Scotland were the best that the Expeditionary Force had received. Probably I am going into history somewhat, but it was exactly the same with sleepers in France. Of these, drawn from several different sources, the best sleepers came from Scotland. There was no doubt about their quality. In later years I was able to compare the sleepers, and feel safe in saying that the Scots wood—Scots pine particularly—was quite the best.

"In connection with the question we are discussing to-day it seems to me that we must have a very large amount of co-operation. It was by co-operation that the enormous supplies of wood sent from this country were obtained—by co-operation of consumer and producer. I think the only way whereby you are going to put British timber on the British market is by attending first of all to your plant. Doubtless some of you have got quite good machinery, but I am convinced that if you are going to make a success of home timber you must scrap a lot of the present plant. The timber is not cut to sufficient length—it is too short. I am quite convinced of that, and, further, in the production of it there is a great deal of waste. I have heard my friends, particularly Mr Munro, throw up his hands with horror and complain of the waste of the Canadians. Knowing the value of timber to-day, I turn round and tell him that he and the other timber merchants are responsible for a great deal of unnecessary waste. If we go to Switzerland we find that the wood that is thrown away in this country is utilised for the making of toys, and for all sorts of small articles of furniture. There is no effort of that kind here to speak of. There is absolutely no reason why wood wasted at present should not be properly utilised and developed by other industries. I suggest that the two big timber associations which you have in Scotland should combine into a corporation with sufficient capital to commence two large installations of proper up-to-date plant, into which every member of the association could send his best material and there have it sawn up to proper specifications and proper dimensions and stored and seasoned. That is done in Switzerland where they have not got so very many more forests, and where, during the war, from rough planking to the finished hut, the same class of associations were large producers to their own profit. There is an example

of this kind—I think in Aberdeen—where all advance comes from. That is the combination of the granite merchants. They have an association for trade through which all their members are supplied to their mutual advantage, and that, I think, is what you want to do. You cannot expect one enterprising man to start on the scale which is necessary, and you must look ahead. I think the only way to develop the home timber trade is by looking ahead and taking a broad view. I just submit this suggestion for the consideration of the meeting and possibly afterwards for a committee, if you should care to appoint one."

Mr Fraser (Landowners' Co-operative Forestry Society) said:—"I think it is now up to the timber merchants to oust the foreigner. I would ask architects and consumers to be a little indulgent. I am sure the timber merchants are only too keen to get their share of the trade that has been going to the foreigner in the past. I think the specification of foreign timber might be utilised for home timber. There must be some sizes now which we could start on instead of waiting for specifications and tests. I know we are selling stuff which competes with imported timber."

Colonel Sutherland said:—"I do not think we should go into this matter with the intention of ousting the foreigner. We cannot supply ourselves without the foreign trade. We must go on for a generation probably before we can hope appreciably to supplement our supplies, and I do hope the foreign timber merchant will thoroughly understand that it is not to keep him out but to endeavour, as far as possible, to make use of an asset we have in this country."

Sir John Stirling-Maxwell said:—"If anyone has the impression on his mind that there should be room for the misunderstanding that Mr Sutherland speaks of, there is some mistake. The intention on my part at all events was to try to show that we were confronted with a shortage of timber which is not very far off, and the difficulty of transport makes it necessary that users of timber, who have mills, should make some effort to supplement the foreign supplies. The use of home-grown timber offers a means of doing that, and one hoped that there might be an opportunity now of diverting the better home wood into other channels."

Mr Mackenzie said:—"In regard to softwood, I speak as a contractor. A lot of gentlemen to-day have referred to the

specification. The building trade of this country has been built up on the foreign specification of sizes, and I think the simplest way is to stick to these sizes. Architects would then know that the same sizes could be got in home timber as in foreign timber. It would simplify procedure all through.

"As regards seasoning, I have had considerable experience in seasoning timber—not home timber but foreign. Foreign timber is cut up mostly in the winter time. It has a considerable amount of seasoning before it reaches this country. For some purposes it is ready for use, for other purposes more seasoning is required. In my own trade I do not consider foreign timber ready for use until we have had it over a year in our own shed properly sticked and thoroughly seasoned. We have often imported logs from Archangel, and we found that while some battens required a year's seasoning, some required eighteen months to two years to season. I would like to point out that the better quality of timber, if you are to get full value, requires to be sticked under cover for eighteen months before it is ready for use. Either the timber merchant or consumer must do that. Of course if the timber merchant does it, he will get more for his timber; if the buyer does it the timber merchant will get less."

Sir John Stirling-Maxwell.—"The point about the foreign specification is a very important one."

Mr Wm. Black (Home Timber Merchants' Association of Scotland) said:—"We have heard a very interesting discussion in regard to the utilisation of home timber and the various purposes it can be used for. I think we have all come to the conclusion now that home timber is in a position to take its place beside foreign timber. I am in rather a unique position here, not only being a home timber merchant but also in the contracting line. Before the war, I, like many of my friends, would not use home timber (even though we had our own mills). But during the war it has been forced upon us.

"In regard to the afforestation scheme, Sir John, unless the Government sees to it that home timber is used in the future, we have every chance of drifting back to the position before the war, because foreign merchants will import all the timber they require, and will not use home timber unless some committee is formed and proper procedure is adopted. There is no doubt

that if home timber is properly graded, classified, and taken care of, there is no purpose for which it cannot be used."

Sir John Stirling-Maxwell.—"Will anyone deal with the subject raised by Mr Mackenzie whether the building specifications should remain as they are, and become applicable to home timber?"

Mr Black.—"There is no doubt that the Scots timber merchants could cut to these specifications, but they might have the material left on their hands, unless the specifications include home timber.

"If you are going to make home-grown timber compare with imported timber, you must first of all cut it at the right time and cut it to the proper sizes. Let your merchants sell your home-grown timber side by side with the foreign timber. There is no reason why the home-grown timber should not be used equally and alongside of the best foreign timber, especially European timber. We cannot compete with the finest of the American forests."

Mr J. T. Smith said:—"With reference to Mr M'Laren's statement in the House of Commons about Scots pine, Mr M'Laren did not say whether his experience referred to seasoned pit-wood or unseasoned. I have got here some figures, a table of results obtained by the North of England Mining Association some months ago, from which they could prove that Scots pine grown in Scotland was increased 40 per cent. in strength after four months' seasoning, and they also proved that home-grown timber seasoned is stronger than foreign timber by 13·6 per cent."

Mr Watson said:—"It might interest the meeting to know that, working for the Ministry of Munitions, my firm were able to convert green into seasoned timber within ten days. A drying kiln was put up capable of working about 50 standards per week. The timber was sent by the Timber Supply Department and put through this kiln, and within ten days it was manufactured into shell cases and powder cases."

Mr Jones, sen.—"I am just going to give you a little of the experience I have had, and experience is worth a good deal of theory. It is perhaps about fifty-five or sixty years ago that I commenced building property. I commenced then with very little knowledge of the building trade. I somehow thought that timber grown in this country was equal to anything in

other countries. It is quite fifty-five years since I built that property. It is as good to-day as the day it was built and has never had any repairs. It is now nearly forty years ago since I commenced to build works in the shape of a foundry which now occupies two to three acres of land, and not a deal has had to be replaced. The whole of the roof and most of the joisting was all done in home timber, and, I am sorry to say, a great deal of it was not too well seasoned. That to-day is standing quite well. My son, perhaps a bolder man than his father, set about building a house all of home timber, and he built every part of that house. The floors were partly of Scots pine, silver fir (a much-abused wood), with a good deal of larch, and every door was of larch—that was the boldest thing he tried. Not a door has gone out of joint, and that was six to seven years ago. That is our experience of home timber."

Sir John Stirling-Maxwell.—"It has been suggested that our conference would have further utility if its work were prolonged by the formation of a committee. I mean to watch the development on the lines we have been discussing."

Dr Borthwick said:—"A committee should be formed to deal with the utilisation of home timber. I make the motion that such a committee should be formed as the outcome of this meeting."

Mr Lumsden seconded the motion, which was carried.

6. Continental Notes—France.

By A. G. Hobart-Hampden.

I.—All the world will now be hunting for timber, and since the forests of Europe (except perhaps those of European Russia, at present more or less useless because of civil war) must have been terribly overcut or destroyed, it will be in regions outside Europe that the search will chiefly be made. Therefore a note in the *Revue des Eaux et Forêts* on the forests of eastern Siberia, by M. Arnould, should be useful. The forests of Russian Asia are believed to cover 888 million acres, but of course the greater part is difficult of access. On the east coast of Siberia, however, and along the Amur river the difficulty is less. Nearly the whole littoral is forest-clad. Here there are said to be some 25 million acres. The most important and abundant species are the Korean pine (*Pinus corensis—P. Koraiensis?*) and the ash (*Fraxinus manshurica*)—to use M. Arnould's terms—and following them the oak (*Quercus mongolica*) and the walnut (*Juglans manshurica*). The pine is very light (and so easily transported), with a very soft and homogeneous wood, which nevertheless is very resistant to compression and to rupture. The oak is very hard and strong, but very heavy. The ash is a little less heavy than the oak, but even more resistant to compression and rupture. There are other timbers very suitable for cabinet-making, but it is building timbers that we shall be needing.

The forests of the Transbaikal Province are supposed to cover some 127,400 sq. miles, or 65 per cent. of the province. The species are Scots pine, larch (*Larix dahurica*), Cembran pine, a silver fir (*Abies sibirica*), a spruce (*Picea obovata*), birch and aspen. The country lacks means of transport, but there is the Siberian railway and some navigable rivers. It is mountainous, but not excessively so.

The forests of the province of Irkutsk have an area of some 37,450 sq. miles, without counting one district for which no information is available. The species are pretty much the same as in Transbaikalia. As in the latter province the population is very small. There are a number of large rivers running north and some railways.

II.—M. P. Fatou, in describing the course of thinnings in a forest of beech and oak, states his opinion that a great gain in

revenue would result from the strengthening of the *personnel* to an extent that would allow of working very intensively. One school would say that the proper course of operations is to begin with a "cleaning" (meaning thereby practically only the freeing of the heads of the more valuable *species* threatened by species of less value) in the thicket stage, followed by frequent, but cautious, thinnings till the forest has attained its full height-growth (at about some 60 years of age perhaps), after which the thinnings may be less frequent but more thorough. M. Fatou, however, considers that it would be of great value to begin at the thicket stage, not merely with a "cleaning" (as above defined), but actually with a true thinning, to free the heads of the more promising *stems*, since in point of fact a close thicket means excessive competition for the moisture in the soil. This thinning of a thicket is something of a counsel of perfection, but we think would be sound if the time for it could be found. This operation should, according to M. Fatou, be followed by what is called ordinarily the "first thinning," at about the age of 15 or 20 years, but we think the time for this operation should really be fixed by the condition of the young wood—since in some places, probably in most, beech is far too slow-growing for such an early date. In this operation he would completely clear the heads of the "stems of the future" so that they touch no other crowns around them, and this he considers a matter of the first importance. The thinnings that follow, up to 60 years of age, should, according to him, again free the heads of the "stems of the future" from all contact, after which the thinnings need not be so severe. By that time he believes the stems left standing will all have nearly sufficiently large crowns for their needs. He thinks (and this also connotes intensive working) the thinnings should be at 6-year intervals up to 60 years of age, every 8 years from 60 to 90, and every 10 years or so after that.

It will be seen that M. Fatou's method is less cautious in the early stages, but more so later, than the method stated at the beginning of this section, and it is a question whether as good height-growth would be attained by his plan.

In this connection it is arguable whether the principle of picking out the "stems of the future" and thinning all round them is preferable to the other system by which one considers

the grouping of the crowns as a whole, and—as long as they are all fairly good—takes out the one or two stems the removal of which will best relieve the congestion in the canopy—and *merely* relieve the congestion. I refer to a thinning in forest of small or moderate age—and in such conditions I think the second system the better, firstly, because, given a chance, any of those fairly good stems which are left will in fact become quite fine trees eventually, and, secondly, because the well-being of the crop as a whole—and not merely that of individual stems—is considered. It is merely a personal opinion, with which I daresay most people will not agree. If one goes into a crop of poles of relatively small age one is *constantly* met with this question, "Here is a group of stems, all fairly good, and where the removal of one stem from the middle will relieve the congestion to the desired extent, but unfortunately that stem is somewhat better than those around it: shall I cut 3, 4 or 5 relatively inferior, but fairly good, stems around the somewhat better one in the middle (the 'stem of the future,' that is), or shall I sacrifice the one good stem in the interests of the 3, 4 or 5 others (in the general interests of the canopy, that is)?" It is a very crucial question, but I incline to the second system, because I believe that, at the stage we are considering, it is not too late for the stems on the outside of the group to become valuable trees, and I think that in this way we can better avoid dislocation of the canopy, not merely at the time of the operation, but also in future operations. I do not apologise for enlarging on this subject, for I think one is apt to be careless in thinning, whereas there is perhaps no operation requiring more careful forethought.

III.—A.S. in the *Bulletin de Franche Comté et Belfort* gives the history of a "Coupe" (Felling unit) of coppice-with-standards, of 7·23 hectares, for a long period, a story which well bears out the motto of the Royal Scottish Arboricultural Society that trees are growing while we're sleeping. In the author's table (which follows) the reserved trees are divided into "baliveaux," "modernes" and "anciens," which, being interpreted, means, respectively, stems that have stood 1, 2 and 3 or more rotations, and we may call them "small, medium and large." As will be seen the rotation is 25 years.

Year	Stems Reserved				Stems Felled	
	Small	Medium	Large	Total Volume	Number	Volume
				Cub. Metres		Cub. Metres
1844	280	...	...	12	...	...
1869	720	42	...	40	156	36
1894	924	356	7	155	122	27
1919	1700	603	25	305	414	161

In spite of the increase in the number of reserved trees the amount of fuel and of bark extracted remained pretty nearly constant at 600 stères and 35,000 kilos, respectively. (A "stère" is a cubic metre as a stack.) This bears out Gurnaud's contention that the branches of the standards compensate for the reduction in the growth of the coppice, while their trunks are all so much to the good. The revenue used formerly to be about 460 frs. a hectare, but is now 680 frs., in consequence, our author says, of the increased amount of timber, but no doubt it is also due to the circumstances of to-day.

The fact is that unless records are kept one does not at all realise the extent to which a wood grows, more especially if one lives beside that wood, so that when one is faced with reliable figures one is quite surprised. An example of this may be given. In April–May 1914 (that is practically before the year's growth began) I enumerated 3 acres of woodland, recording the stems by calliper classes of a foot of girth at chest-height. It is a very thin wood. For a special purpose I took a line 16½ feet wide for 120 chains straight forward through the wood, recording whatever fell within this line. Each tree was marked with a spot of white paint, about 4¼ feet from the ground, so that whenever measurements are taken the operator may face the same way (he would always face the spot) and take the measurements at the same place. Having done this, I calculated the cubic feet of utilisable timber from data which I have collected for a dozen years, and which experience has shown to be reliable. It is true these data are obtained from felled stems measured by quarter-girth and string measurement, and are further vitiated by an absurd convention which obtains here, according to which the stems are lengthed to yards (fractions of a yard being omitted), and each yard is

38 inches instead of 36—but this will not affect the *comparative* table which I append below. It will be seen that some stems have disappeared, and that there have been practically 6 years of growth.

In April–May 1914 there were :—

	Girth			Cub. ft.
32	Beech of 0–1 ft.	×	·25* =	8
195	,, 1–2 ft.	×	1·5* =	294
156	,, 2–3 ft.	×	7·3* =	1139
91	,, 3–4 ft.	×	19·5* =	1775
14	,, 4–5 ft.	×	30·4* =	426
1	,, 5–6 ft.	×	46·5* =	47
			Total	3689
3	Oak of 1–2 ft. girth			5
6	,, 2–3 ft. ,,			44
14	,, 3–4 ft. ,,			273
10	,, 4–5 ft. ,,			304
			Total	626
2	Ash of 1–2 ft. girth			3
4	,, 2–3 ft. ,,			29
2	,, 3–4 ft. ,,			39
			Total	71
1	Span. chest. of 2–3 ft. girth			7
1	Sycamore of 1–2 ft. girth			2
1	,, 2–3 ft. ,,			7
Total trees, 533			Total	9
			Grand Total,	4402

On 1st October 1919 there were :—

		Cub. ft.
26	Beech of 0–1 ft. girth	6
164	,, 1–2 ft. ,,	246
144	,, 2–3 ft. ,,	1051
99	,, 3–4 ft. ,,	1931
32	,, 4–5 ft. ,,	973
2	,, 5–6 ft. ,,	93
1	,, over 6 ft. ,,	74
	Total	4374
2	Oak of 1–2 ft. girth	3
5	,, 2–3 ft. ,,	37
13	,, 3–4 ft. ,,	254
10	,, 4–5 ft. ,,	304
2	,, 5–6 ft. ,,	93
	Total	691
1	Ash of 1–2 ft. girth	2
3	,, 2–3 ft. ,,	22
3	,, 3–4 ft. ,,	58
	Total	82
1	Span. chest. of 3–4 ft. girth	20
2	Sycamore of 2–3 ft. girth	15
Total trees, 510		
	Grand Total,	5182

* *Note.*—Factor corresponding to the number of cub. feet in an average stem of the girth class.

The trees on the area have therefore increased by 780 cub. feet in 6 years, or 260 cub. feet per acre, or 43·3 cub. feet per acre per annum. Possibly these figures may be small (reasons why they should be have already been given), but the point is that almost any figures of the kind will surprise us when we actually sit down and work them out, and it is very useful to do this, for hardly anyone appreciates the amount of material that is steadily, year by year, being added to our woods—those woods

which to our casual glance always look very much as they have ever done. And another thing is surprising, namely, the fact that stems disappear constantly and at a far greater rate than one ever suspects. In the present case 4·3 % disappeared in less than 6 years, and they could not have been illicitly cut in this particular place.

IV.—M. Demorlaine in *La Vie Agricole* has an article on the reconstruction of the French forests. Leaving aside the forests away from thé zone of war, which, however, have of course suffered greatly from over-exploitation, in spite of every care, he divides the area directly affected by the war into two classes, viz., a band of some 10 kilometres wide and 700 kilometres long, where the armies were long embattled in a war of position, and wherein the pre-existing forests have been completely destroyed—the forests of the field of battle—and, secondly, two bands of 10 kilometres wide on either side the first one, wherein the operations of war required an immense utilisation of wood, but where the forests have not *completely* disappeared. A band thirty kilometres in width is therefore considered by M. Demorlaine.

The field of battle is now a sea of huge pits where formerly there were fields and woods, and altogether impossible to cultivate, and the boundaries of properties are quite lost. The Reconstruction Service is resurveying all this country, and the necessary levelling and cleaning operations are, it is believed, to be carried out by the State; in fact the State—if we have correctly understood—is taking over the entire reconstruction of the area affected. For one thing, the danger to be anticipated from unexploded shells renders it unwise for any but expert persons to undertake the cleaning up. The humus in the woods has been dissipated, and it is said that the devastated agricultural land is now quite unculturable. In passing, is it so certain that the upheavals caused by shell explosions is an unmixed evil? We seem to have seen somewhere that the pulverising of soil by explosives has an actual value. However this may be, the French Reconstruction Service appears to be going to afforest the agricultural lands (or a part of them) within the area we are considering, with a view to restoring fertility to the soil, thereafter returning to the proprietors such of them as have not meanwhile been bought by the State.

It is estimated that a 100,000 hectares (247,100 acres) of land, either forest or agricultural, need complete reconstitution. This area is found in three principal regions—the neighbourhood of Verdun, Champagne (Reims to Soissons), and the Somme (Arras to Péronne).

M. Demorlaine considers that conifers should, for the most part, be used for the reafforestation of the old forest areas, and that conifers should specially be employed in the old agricultural land as being more suitable for *transitory* work. No doubt the ground will be most rapidly covered by conifers, but will these latter sufficiently restore the fertility of the soil? If it is not intended to retain such lands as forest surely some rapid-growing deciduous species would be best, at least in combination with conifers.

Our author thinks that Scots pine should be used on granitic or sandy soils, *P. Laricio* on chalk, and Weymouth or Douglas on moist soils.

M. Jolyet thinks, for his part, that, although the conifers give quick returns, they should not be exaggerated, and that it will be advantageous to plant an upper stage of conifers, spread more or less widely, with an understage (or interstage) of deciduous trees; this, at least, in the plains. His reason is that pure conifer woods suffer greatly from insects and fungi—particularly when the species is out of its true habitat—and it is always the less vigorous stems that suffer most. Indeed it seems to me that practically the only way to counter fungi and insects is to grow your woods in full vigour. Now to grow vigorously trees need light—especially (among conifers) larch and most of the pines.

I may here confirm this by noting a remarkable case of vigour, enabling a plantation to throw off a fungus attack, which has come under my own direct observation. The plantation in question is of larch in a windless hollow. It was originally very crowded, having in addition to the larch stems a great many naturally-sown ash, and it was found, some six or seven years ago, that the *Peziza* was very prevalent indeed. Accordingly I thinned out the plantation, and this year again I have been at work there, since much snow-break has forced me to take it in hand. I find that there has been vigorous growth and that the *Peziza*, formerly so prevalent, has disappeared and has not resulted in canker to any great extent. I have also met a very

remarkable case of vigour enabling a Douglas plantation to throw off a fungus attack, but as I have already mentioned it in a previous number of the *Transactions* I will not repeat it.

Snow-break is much worse in a pure conifer wood, as close-grown stems with persistent leaves hold up the snow like a roof till it collects into a mass of enormous weight.

Assuming that 100,000 hectares have to be afforested, and that 5000 plants are used per hectare, 500 million plants, at a low estimate, will be required. Can such great quantities be found quickly in Europe? If not, would it not be worth while to experiment with many exotic species growing in similar climatic conditions, and in the northern hemisphere? We may remember that when the latitude is lower altitude in such latitude will give us the necessary correction. Thus the field for obtaining seed will be greatly extended.

One great point—not generally considered—is that when a conifer has a relatively large space to grow in, the wood becomes heart-wood more quickly. It is of course true, on the other hand, that the quick-grown conifer is less valuable than the slow-grown, but one may reflect that if quality suffers quantity increases, and when all is said and done coniferous wood is generally used under cover and there quality is not of great importance. It may be noted in passing that M. Jolyet states, as an interesting exception, that quick growth in a Douglas does not militate against quality, inasmuch as unusual widening of an annual ring is found to occur more in the summer than in the spring.

By introducing deciduous species between the conifers the decomposition of the needles of the latter is more rapidly effected by the addition of the leaves of the former. M. Jolyet says: "I suppose it is the case that the resin in the needles is a preservative, and that slow decomposition has the drawback of producing swampiness."

In any case it is common knowledge that the best conifers are to be found in a crop of beech, provided their heads are free, and is it not the case that the best soil-enrichers are deciduous?

V.—M. Jolyet, in considering the great danger from insect invasions in the forests damaged by the war, mentions an

acetylene lamp as used in vineyards for destroying night-flying noxious insects, and in addition has conceived the idea of actually introducing bats into the woods. For this purpose he would build small sheds, so made that during winter the cold may be kept out. He is careful to explain that all species of bat would not be equally valuable in this connection, and would employ those which are accustomed to inhabit lofts and barns, or hollow trees, excluding those which hibernate in grottos. The kind he suggests is called "Vespérien" (I am not in a position to translate this word). He would adopt various precautions when installing his bats in the forest huts. Possibly there is something in the idea where there is an invasion of night-flying harmful insects. As for diurnal insects, it is not at all a foolish idea to import an enemy which preys on them, for we may remember how the importation from Australia into California of the ladybird, an insecticide, completely saved the orchards which had been badly attacked by insects.

7. Coniferous Forest Trees in Great Britain.

By H. M. Steven, B.Sc.

In this article the various conifers of importance in British forestry will be dealt with. Their growth under different conditions of soil, elevation, exposure, etc., will be considered, and an effort made to state the environmental requirements of each species. The principal silvicultural problems that arise in the growing of each conifer will also be discussed. Finally, an attempt will be made to reach a conclusion as to the position of the various conifers in the development of forestry in this country.

Hardwoods will only be considered when of importance in the growing of conifers—for instance, the use of birch as a nurse and of beech as a soil improver.

The pines, larches, spruces, and other conifers will be dealt with in turn.

PINES.

Of the pines, three are of importance, viz. Scots pine, Corsican pine, and Weymouth pine.

Scots Pine (*Pinus silvestris*).

Of all our conifers, Scots pine alone is indigenous to this country. In various parts of the Highlands there are still remnants of the original natural forests. The largest in extent is the Abernethy Forest in Strathspey, of which a considerable portion was cut for war purposes. As regards the size of the individual trees, the most notable is the Glenmalie Forest in Lochaber. It consists of a fairly narrow belt, which, until recent fellings, extended for over 10 miles near Loch Arkaig. Some of the trees felled during the past few years contained up to 250 cubic feet (quarter-girth). The Balloch-buie Forest, Balmoral, is interesting from the point of view of elevation. Some of the best portions of it, *e.g.* Glenbeg, are over 1200 feet above sea-level.

Some reference must be made to the existence of different growth types of this species. Even a casual observer will note differences between the trees in our natural forests and those generally found in Scotland and England. It is fairly certain that many of the latter have been grown from foreign seed of not too good a type. The natural forests are not all of one type, but appear to graduate from the ordinary form to what is known as the Strathspey type. The principal differences between this type and the ordinary one are:—

1. It has shorter and stiffer needles.
2. The crown of the tree is smaller and more cylindrical.
3. The branches are thinner.
4. The bark is thinner.

It is interesting to note that there are areas of this Strathspey type in Northern Sweden. It is believed that the trees have been grown from seed received at one time from Strathspey. From descriptions given in Swedish and German journals the trees appear to have remained true to type in their new home. An investigation into growth form in this country is required in order that we may obtain the best type.

Scots pine regenerates itself naturally, to some extent at least, on most heather ground. The regeneration is systematically carried out in Strathspey by the gradual removal of the old trees. In many cases, *e.g.* near Boat of Garten, a very complete young crop is obtained at the end of 10–15 years. It is fairly certain that this species could be obtained naturally in many

places either by this method or probably more certainly by the strip method, *i.e.* the successive felling of narrow strips, provided protection was afforded against sheep, deer, rabbits, etc.

It is often stated, both in text-books and elsewhere, that Scots pine will grow under almost any conditions. It is true that it will exist on a wide range of soils, elevations, and exposures. The conditions, however, under which Scots pine will give a reasonable mean annual increment per acre of timber are strictly limited. It must always be remembered that it is this mean annual increment of timber, together with the money value of such timber, that determines whether any particular area can be economically afforested or not. Beyond a doubt many of our fairly well-stocked woods of Scots pine have not given and are not giving an economic increment. In forestry, as in other industries, the call must be for greater production. It is the only way to establish the industry on an economic basis, having regard to the greatly increased cost of forming and tending plantations. The increment can undoubtedly be increased by better management, but in many cases it will be necessary to seek for some more productive species for conditions which previous forestry experience has considered suitable for Scots pine.

Scots pine attains its fullest development on fairly well-watered sandy soils, at comparatively low elevations, in sheltered positions. It does not require too fertile a soil, and is comparatively immune from late frosts. It rarely gives satisfactory results on peat of any depth. In the past Scots pine has often been used as a shelter tree at the upper limits of plantations and on exposed knolls. From a production point of view, it is rarely satisfactory in such situations, but it is improving the soil conditions and is thus preparing for more productive species.

Unfortunately, Scots pine has many natural enemies which are not only numerous but also widely distributed. The roots of the newly-cut stumps of this species are the breeding-places of the pine weevil (*Hylobius abietis*), and this weevil then sallies forth and does most serious damage to young plantations, not only of Scots pine but of practically all conifers. In some cases, especially when allied with other species of beetles, *e.g.* species of *Hylastes*, and with drought, this enemy is responsible for the complete destruction of young plantations.

Immediately following this period, another beetle, the pine beetle (species of genus *Myelophilus*), is very destructive. This beetle breeds under the bark of dead and dying Scots pine, then burrows in the living shoots of the trees; these break over, and the crown development is consequently interfered with. Another and probably an even more serious enemy now appears, viz. the squirrel. In England and those parts of Scotland where there are many nut-bearing hardwoods, the squirrel does not generally attack conifers, but in the absence of such hardwoods, this animal does very great damage. The squirrel tears off strips of bark from the stem in the lower part of the crown in order to lick the sap. The tree is either girdled and thus killed, or the stem dries and is easily broken over by wind or snow. The author has seen large areas of Scots pine, hundreds of acres in extent, where there was scarcely a tree which had not been damaged in this way. When the squirrels are very abundant, spruce and larch are similarly attacked, but Scots pine is undoubtedly the favourite victim. These are the most serious of the enemies of Scots pine, but by no means the only ones. Unlike most other conifers, the pines in woods having a complete canopy improve the soil, *e.g.* on the sand-dunes of the Landes in the south of France. In the course of one rotation a pure sand is frequently converted into a black loam to a depth of 6 inches or more. This not only increases the soil's fertility, but increases its power of retaining water, a very important matter. The only disadvantage of the humus thus formed is that it is slightly acid.

Scots pine occupies an important place in the home timber trade of this country, as up to the present it has been our principal forest tree. It is converted into sleepers, boarding of all sizes and for all uses, and pit-wood. As regards strength, durability, and weight, it occupies a definite position, intermediate between larch and spruce.

It can be seen that the position of Scots pine in the future development of forestry in this country requires careful consideration.

Experiments should be carried out to determine—

1. How far other conifers can be profitably used to replace Scots pine under conditions which have hitherto been considered suitable for it but under which it has not given satisfactory results.

2. How far the productivity of the species can be increased by improved silvicultural treatment.
3. How far the various insect pests can be reduced to manageable limits.

Full use of the new Forestry Act should be made to eliminate the squirrel as a forest pest.

Scots pine is a forest tree which should not be viewed solely from the point of view of productivity. Its value as a means of restoring fertility to impoverished forest soils should be remembered.

In the author's opinion the percentage area under Scots pine should be considerably reduced, but he is convinced that our indigenous conifer will still retain an important place in the forestry of this country.

Corsican Pine (*Pinus Laricio*).

Corsican pine is the maritime variety of *Pinus Laricio* which is found over considerable areas of southern Europe. It has been planted to some extent in Scotland, England, and Ireland. It produces slightly more timber than Scots pine, and gives slightly better results on the poorer and drier soils and more exposed situations. It has given satisfactory results on the poorer sands. On the other hand, the timber does not appear to be so strong or durable as our indigenous pine, nor is the plant so frost-hardy. Its principal disadvantage is the difficulty of transplantation; it requires to be planted out, either early in the autumn or very late in the spring. The lack of appreciation of this fact probably accounts for many of the failures which foresters have experienced. Sir John Stirling-Maxwell's experience suggests that it is specially sensitive to the drying of the root fibres. This species has not been sufficiently widely planted to enable a final conclusion regarding it to be reached. Experiments are needed to determine its suitability to different conditions, its productivity, the strength and durability of its timber, and the best methods of establishing and tending it.

Weymouth Pine (*Pinus strobus* and *Pinus monticola*).

This is the white pine of North America. Two species have been planted in this country, *Pinus strobus*, the white pine of the north-eastern region, and *Pinus monticola*, the white pine

of western North America. Both species attain a large size in their natural habitats, and the timber has a wide range of uses. A fungous disease (*Cronartium ribicolum*) has caused serious damage to these species both in this country and elsewhere in Europe, and has greatly limited their use. This disease is now a serious one in America. It is believed that it was imported from Europe. There are several young plantations in this country which are so far free from disease and are showing good growth. In Germany the disease was found to be less serious on certain soils, and it should be a matter for experiment in this country to determine under what conditions, if any, we can grow this valuable conifer.

LARCHES (*Larix*).

Two species of larch are, at present, of importance in forestry in this country, viz. European larch and Japanese larch.

European Larch (*Larix Europea*).

This species was introduced about two centuries ago into this country from the mountains of Middle Europe. Larch trees which were planted in the early years of the eighteenth century are to be found growing in various parts of the country—one of what were known as the "Parent Larches" still stands at Dunkeld.[1]

Although the natural habitat of the larch is the mountains, it has been planted in this country under all possible conditions. The effect of the planting of this species under unsuitable conditions, and probably also by keeping the plantations too dense, has been to weaken its resistance to disease. Larch now suffers from a very serious fungous disease known as larch canker or blister (*Dasyscypha Willkomii*). As this disease has an important bearing on the various problems connected with larch, it will be briefly considered at once. This fungus is what is known as a wound parasite, *i.e.* infection is by means of spores through wounds in the host. The spore or spores germinate, grow, and destroy the vital tissue lying immediately beneath the bark. The exudation of resin is the first obvious symptom of the disease. The successive cutting-off of the destroyed tissue by

[1] Schotte's views in regard to the Scottish type of larch are discussed in Mr Murray's summary of the Reports of the Swedish Forestry Research Institute, in this issue, p. 98.

layers of cork frequently causes malformation of the stem and deep wounds which often remain visible for a long time. Young trees and the younger parts of old trees are attacked. The young trees are in many cases killed, and although many recover there is a permanent injury to the timber, owing to the scars and malformation. From the evidence of the timber in our older larch woods and from local information, it is fairly certain that this disease did not become a serious danger in some parts of this country until towards the middle of last century. There does not appear to be any remedy other than through the silvicultural treatment of the species, and this will now be considered.

There is a large area of afforestable land in this country. Besides assisting allied industries, it is the task of forestry to use the available forest trees first of all to obtain the maximum production or quality of timber from the forest land, and secondly, to maintain and, if possible, to increase its fertility. Larch is a specially interesting species, for, on one hand, the value and utility of its timber make it desirable to plant it as widely as possible, while, on the other hand, its liability to canker makes it necessary to choose its location wisely and to tend it with care. Further, owing to its having a light canopy, it tends to exhaust the soil, hence one of its most important silvicultural problems is how to grow it without deteriorating the soil.

Unlike Scots pine, larch is not a suitable forest tree on moraines. It may grow fast, but, especially on the second rotation, it rarely remains sound beyond middle life. This species does well on a fertile sandy loam derived from schists, slates, and some shales. It frequently gives remarkable results on very rocky soils. Although larch will not give good results on water-logged soil, a continuous and abundant supply of water during the growing season appears to be necessary for rapid growth. This, in part, probably explains its remarkable growth in many places on the west coast from Devon to Ross-shire, *e.g.* at Braemore in Ross-shire a height of 70-80 feet has been attained in 50 years at an elevation of 400-500 feet above the bottom of the valley. Very dry slopes generally necessitate a short rotation for this species. Larch has attained a large size in well-sheltered positions at low elevations, *e.g.* in such places around Dunkeld it has attained 120 feet in height in about 80 years. Such rapidity of growth in a naturally

slow-growing species may reduce resistance to disease, hence, in the opinion of the author, it appears desirable to restrict this species to the higher elevations and less sheltered positions. A considerable degree of shelter is necessary, and, provided that is available, larch will give satisfactory results at elevations up to 1500–2000 feet above sea-level, or 500–1000 feet above the bottoms of valleys, *e.g.* in Upper Deeside and Strathdon. This species does not suffer excessively from late frosts. Larch is not a suitable species on peat or peaty soils. To summarise briefly, larch is a suitable species on fertile, well-drained but well-watered sandy loams at the higher elevations (*i.e.* 300 feet upwards above the bottom of valleys), with a fair degree of shelter.

Although this species has been grown in this country for a long period, few naturally-regenerated woods exist. There is a very interesting young natural larch wood on Tominourd Hill, Strathspey. The previous crop was a mixture of larch and Scots pine. The larch regenerated itself first, and portions of the hill are covered with pure larch. Where there are gaps these are filling in naturally with Scots pine. This order might be explained by the relative abundance of seed immediately before and during the period of regeneration. The only drawback in this case is that the crop has come up too densely.

In the formation of larch plantations, the most important principle is to avoid over-crowding. When a species regenerates itself too densely, or is planted too closely, the canopy closes in a few years. If the height-growth is rapid, as in the case of larch, the struggle for existence becomes too severe unless a very early thinning is made. Such an excessive struggle for existence tends to weaken the whole crop, increases its liability to disease, and retards the development of a good root-system. On the other hand, such an early thinning rarely pays for the labour of making it, as the trees removed are so small. It has frequently been stated that dense planting means clean timber, but after examination of many plantations of this species which were planted very densely, under all conditions, the author has come to the conclusion that close planting does not always mean clean timber. Moreover, for economic reasons, planting costs and non-productive thinnings must be reduced to a minimum. One or more thousand plants less per acre is a considerable

saving not only in plants but also in labour. These observations apply to all species, but they have much greater force in the case of larch, which is a light-demanding species liable to disease and with a rapid height-growth in early life, than in the case of a species such as spruce, which is a shade-bearer and grows relatively slowly in early life. In the author's opinion, the planting distance for larch should not be less than 5 feet, and probably 6 feet will give the best results under most conditions. The same principle should be followed in the tending of larch plantations. They should be thinned early and then every 5–10 years. The thinnings should be moderate to heavy, depending on individual requirements. Only in this way can this species be kept healthy. This method of treatment, however, means that the soil is more or less exposed, hence it deteriorates. This leads to a consideration of the methods that may be employed to preserve and increase the fertility of forest soils carrying larch crops.

Of the different methods that may be used, the following will be briefly considered :—

1. Mixture with a shade-bearing species.
2. Underplanting with a shade-bearer.
3. The rotating of pure larch crops with shade-bearing, humus-forming crops.

Woods may be mixed either in blocks or by individual trees. Mixture by individual trees will be considered first. Many of the larch woods in Scotland are, or have been at some time in their history, mixed woods. The species mixed were larch and Scots pine, and the proportion generally two-thirds Scots pine to one-third of larch. There are large areas available to study the result of this mixture. Unless the conditions are very unfavourable to the larch, the rate of height-growth of this species exceeds that of the Scots pine right from the formation of the plantation. The general result is that the Scots pine are suppressed, and die out either before or during the time they are required as the shade-bearing, humus-forming species. Moreover, in many cases the resulting crop of larch is incomplete, with a corresponding loss of increment. There are two very strong reasons against a Scots pine-larch mixture. First, the relative rates of height-growth of the two species differ considerably, and second, as has already been stated, the

optimum conditions for the growth of each species are by no means the same.

The mixture of larch and spruce has probably to some extent been discouraged by the knowledge that these are the alternating hosts of aphid pests of the Family Chermesidae. The wonderful adaptability of these insects to any condition, however, makes it immaterial whether the two hosts are planted in proximity or not. As will be seen when the spruces are discussed, the mixing of larch and Norway spruce is open to the objection that the relative rates of height-growth are not the same in early life, hence the spruces, in many cases, are suppressed. In the author's opinion, there is a possibility that a larch-Sitka spruce mixture might be successful. This should be a matter for experiment. Of the other conifers, the author has seen a quite successful larch-silver fir mixture, and this should also be a subject for more extensive trials. Larch-Douglas fir is useless, owing to the much more rapid growth of Douglas fir as compared with larch.

From a silvicultural point of view, the mixing with certain hardwoods, such as beech and oak, would be more beneficial than with conifers, owing to their superiority as humus-formers. Some of the larch woods in Wales and in Ireland were planted on oak-coppice areas. The few oak standards which have come up with the larch have undoubtedly improved the soil conditions. On areas suitable to beech, the mixing, say, 5-10 per cent. of this hardwood with the larch would certainly help to maintain the soil fertility, and would probably increase rather than decrease the volume production of the larch. This should also be a matter for experiment.

The successful mixing of larch with a shade-bearing species by means of individual trees would solve many of the silvicultural problems connected with the species. It is certainly a subject for research and experiment.

The mixing of larch with shade-bearers in blocks would avoid many of the disadvantages of mixing by individual trees while retaining a few of the advantages. Many of the areas suitable for larch consist in part of spruce ground. The breaking up of pure larch woods by belts of spruce would reduce the exposure of the soil. Further, any existing groups of hardwoods, even rowan, willows, and alder, should be left and encouraged. The choice of species and the tending of the crop is more straight-

forward when the mixing is by groups. It is the method which has been generally followed in recent years, and it should be continued until experiments demonstrate a better method.

The method of underplanting with shade-bearers will now be considered. It has been tried on a small scale in several places, notably at Novar in Ross-shire. Underplanting can be used to meet two different situations—first, where a larch crop has become open at an early age owing to deaths from larch canker, and secondly, when the crop opens naturally at a later period. In the first case, it would appear that a shade-bearing conifer should be used, as not only should an effort be made to protect the soil, but also to replace, so far as possible, the depleted larch increment. In the second case a hardwood, such as beech, would appear to be most useful. For under such conditions the shade would be greater than in the first case, so that no conifer would grow fast enough to reach a measurable size before the end of a moderate rotation. Thus, as the only use of the underplanted tree would be as a soil improver, the best species for that purpose should be chosen, viz. beech. The choice of the most suitable conifer for the first set of conditions is a matter of importance. The principal requirement is fairly rapid growth under considerable shade. For this reason Douglas fir does not generally give very satisfactory results unless the wood has become very open. The silver firs naturally suggest themselves, and of the silvers *Abies grandis* is probably safest, owing to its apparent immunity from the destructive silver fir *Chermes* pest. The rate of growth of silver firs, however, is slow in early life. *Tsuga Albertiana*, *Thuya* species, and *Cupressus* species all require further trials. Experiments have already been made to determine the best species for this purpose, but they require to be extended to include a wider range of environmental conditions.

The principal objection to the method is the difficulty of tending the resulting plantation. If one favours the larch crop, many of the underplanted species are sacrificed before they are a marketable size, while if the lower crop is favoured by the gradual removal of the larch, the final crop is rather patchy and irregular.

A third method is to grow the larch pure and follow it with a soil-improving species on a short rotation. For instance, a 60-70-year larch rotation could be followed by a 30-40 Scots

pine rotation. Generally speaking, the growth and productivity of Scots pine is quite satisfactory up to that age; it is thereafter that the falling off takes place unless the conditions are favourable to its growth. If the market for Scots pine pit-wood remains, this method would give a satisfactory return, while any lost fertility of soil due to the larch crop would be restored. In the author's opinion, attention should be directed to this use of Scots pine. Every effort should be made at least to maintain the fertility of our forest soils. The financial success of silvicultural methods should be measured by several rotations, not by the first one alone.

The timber of larch is strong and durable even when in contact with soil and moisture. Its only disadvantage is its weight. It has a wide range of uses, for fencing posts, telegraph poles, boarding for special purposes, and pit-wood.

Larch will remain one of our principal forest trees, but it will require more careful choice of location and skilful tending than it has hitherto enjoyed.

Japanese Larch (*Larix leptolepis*).

The habitat of this species is the mountains of Japan. It has been fairly widely planted in this country during the last thirty years.

For a considerable time it was believed that Japanese larch was immune from larch canker. This is not so, but up to the present it has suffered much less than the European species. Every effort should be made to ensure that this relative immunity continues, so far as that can be done by careful choice of location and tending.

The principal feature of the growth of Japanese larch is the falling off in height-growth at an early age. There are practically no woods of this species in this country of a sufficient age to determine this question finally, but the older trees we have certainly indicate a marked falling off. This appears to be the case in Japan. According to Kumé the height-growth up to the 30th year is very fast, viz. 68 feet for Quality I., 60 feet for Quality II., and 58 feet for Quality III. Thereafter, however, there is a marked decline in height increment.

As regards soil requirements, this species appears to be less exacting than European larch. Japanese larch generally gives

much better results on the less fertile soils than the European species. It likes a well-watered soil, but it is on areas having a comparatively low rainfall that it compares most favourably with its European cousin. Its upper elevation limit in this country has still to be determined. In Japan it attains its best development at elevations of 3000 feet above sea-level and over. In Wales there are plantations, 30 years old, showing satisfactory growth at an elevation of 1500 feet, but in other parts of the country the limit may be lower.

The growth habit of Japanese larch is coarse; the branches are more at right angles and are thicker than those of European larch. Some foresters have attempted to remedy this by closer planting, but this appears to be undesirable. The great object should be to maintain the health of this exotic. The planting distance and general treatment should therefore be as suggested for European larch. The canopy of the Eastern species is heavier than our own, hence it may not impoverish the soil to the same extent.

Owing to its growth habit the timber is rougher than that of our own species. As far as experiments have been made, however, the timber appears to be satisfactory for pit-wood. In Japan it is used for sleepers, fencing posts, telegraph poles, etc.

In the author's opinion, where the growth of European larch is satisfactory it should not be replaced by the Japanese species. There appears to be a definite place for the latter species, viz. where a short rotation is desired on the less fertile soils with only a moderate or scanty rainfall. Investigations should be made to determine how far this species can be used to replace Scots pine on some areas where the growth of the latter species does not give a satisfactory return. During the next 20 years the existing plantations will show if there is to be a falling off in height-growth in this country. A thorough study should be made of the timber properties of the Japanese species. Finally, every effort should be made to maintain its health. It should not be planted at the bottoms of sheltered valleys or overcrowded at any time during its life.

SPRUCES.

There are three spruce species of importance, viz. Norway spruce, Sitka spruce, and white spruce.

Norway Spruce (*Picea excelsa*).

This species was introduced into this country about the middle of the sixteenth century. It is widely distributed in Europe from Norway southwards. In southern Europe it is found chiefly on the higher mountain ranges, for instance, in South Tyrol, at elevations up to 7000 feet above sea-level. It is one of the principal forest trees in continental Europe. In the past it has not been as widely planted in this country as its qualities merit.

Relative to the species already discussed, Norway spruce is free from serious enemies, insect, fungoid or otherwise. The only exception is heart-rot, which appears at middle life under certain conditions. This necessitates a short rotation under these conditions.

Spruce gives satisfactory results, at least to middle life, on a wide range of soils. This species will grow on peat provided it is not deep; indeed a few inches of peat is an advantage rather than a disadvantage. Provided a good water supply is available, it does quite well on rocky slopes. To attain its full development a large water supply is necessary. Undue weight, however, has probably been given in this country to this requirement. Compared with the production of other species, spruce gives good results where the rainfall and general water supply are only moderate. Owing to spruce having a surface root-system, it is subject to windfall when planted as single trees or small groups. This, in part, probably explains why it has not been more widely planted at the higher elevations in this country. Elevation and a considerable degree of exposure are no bar to the planting of this species if it is done in solid blocks. There are plantations in this country showing satisfactory growth at elevations up to 1500 feet above sea-level, for instance, in the Pennines and in Upper Deeside. Late frosts frequently do damage to it in early life. Where available, birch scrub will give the requisite shelter from frost.

For very rapid growth a sheltered position, a fertile soil, and abundant water supply are all necessary, but satisfactory results are obtained when the fertility of the soil, water supply, and degree of shelter are only moderate.

Spruce is the only tree which can be extensively planted in this country to give a high mean annual timber increment per

acre. Its volume production is almost twice that of larch under similar conditions.

The timber of Norway spruce is light and fairly durable when kept dry. It cannot compare with larch or Scots pine in strength. Its principal uses are for constructional purposes and for pit-wood.

The principal silvicultural problem to be solved is how to grow moderately clean timber. The dead branches persist for a long time, and the timber grown in this country up to the present is much more knotty than that grown in some other parts of Europe. The trees to form the final crop could be selected at 25-40 years and pruned up to 20 feet. Close planting has been advocated and tried to remedy this defect. Spruce may be planted closer than the species already discussed because its rate of growth in early life is slow even under the best conditions. Hence, in order to close the canopy in a given time, closer planting is necessary. This should not be carried too far, however, especially on the poorer soils. Under such conditions, the roots have to go farther for the food. More root room is necessary on the poorer soils than on the better soils, hence the planting should be wider. Probably even for spruce the minimum planting distance should be 4 feet, and in some cases it should be wider. The side branches are thinner when the plantation is kept dense, but in determining the correct density other silvicultural factors must be considered also. Spruce being a shade-bearer, a heavier stock may be carried throughout the rotation. This heavier stock and the increment which it produces is one of the principal advantages of the species. To obtain the maximum increment and size of individual stems, moderate to heavy thinnings are, however, necessary. The best degree of thinning for the various conditions is a matter for further investigation.

Up to recent years spruce was not a favourite tree in this country. It has now, however, many advocates. As can be seen, the author considers that its requirements are not so exacting as was believed. It nevertheless has requirements, and care must be taken to see that it is not planted in places which do not meet these. Up to the present it has been found very difficult to establish on ground whose principal soil covering is heather (*Calluna*). Spruce is assured of an important place in the forestry development of this country.

Especially in Scotland it has not been used at the higher elevations, but it has a future there both from the point of view of its productivity and also for the effective shelter it will give to other species, notably larch.

Sitka Spruce (*Picea sitchensis*).

The habitat of this species is western North America. As regards latitude the limits of its distribution are wide, viz. from Alaska to California. It attains an average height of 100 feet and a diameter of 3–4 feet, but it occasionally reaches much larger dimensions. It has not been widely planted in this country except as an ornamental tree. There is some evidence, however, that this will be one of our most valuable conifers.

Its soil requirements in this country have yet to be fully determined. In America, according to Sargent, it grows on moist, sandy, often swampy soil, or less frequently, in the far north, on wet rocky slopes. As regards soil, it is fairly certain that this exotic species will grow on most areas suitable for Norway spruce. There is indeed evidence that it is less exacting than the European species, especially as regards growth on peat. There is a plantation 40 years old, at Durris in Lower Deeside, at a considerable elevation, giving remarkable results on 2–3 feet of peat. The other species present, viz. Scots pine, larch, Norway spruce, and silver fir, are all doing poorly. It must be remembered, however, that the term peat does not refer to a definite substance, for, from the point of view of forestry, peat is very variable. Some guide to its quality is given by the natural flora which it carries; the peat referred to above is neither the best type nor is it the worst. If further experiments show that Sitka spruce will give good results on peat, for that reason alone it will be a most valuable addition to our forest trees. The habitat of this species indicates that an abundant water supply favours it. Limited trials, however, show that it gives more satisfactory results than Norway spruce under relatively dry conditions, and it seems probable that Sitka spruce will do well under dry conditions, for its growth on peat shows its ability to withstand physiological drought. Its limitations as regards elevation and exposure still remain to be determined, but it does not appear to be more exacting than Norway spruce.

The requirements of this species in this country have yet to be fully determined. Until that is done, they may be safely taken as similar to those of Norway spruce.

We have practically everything to learn regarding the rate of growth and production in this country. There are several plantations over 20 years old under different conditions available for study. These indicate faster height-growth and heavier volume-production than Norway spruce.

As regards timber, from American experience and our own, limited though it is, it is fairly certain that Sitka spruce is considerably superior to the other spruces. Unlike other species of *Picea* it has a visible heartwood.

It has not been sufficiently extensively planted to enable its silvicultural problems to be determined. It grows faster than Norway spruce in early life, there being a shorter check period, and it probably should be planted at a minimum distance of 5–6 feet. There is a very satisfactory plantation in the south-west borders of Scotland, now about 20 years old, which was planted at 9 feet apart. It will very probably respond to heavy thinnings, but that is still to be investigated. Like other spruces it is difficult to establish on pure heather land, but probably less so than common spruce.

The author knows no species, not even Douglas fir, which gives greater promise than Sitka spruce. Its various problems should be investigated without delay, both by experimental work in this country and by a study of its growth in western North America.

White Spruce.

This species is a native of the north and north-east of North America. Its soil requirements are less exacting than those of the other two spruces discussed, and the tree has been used with other conifers for the fixation of sand dunes. Its place would probably be on the dry, poorer soils. It is more frost-hardy than the other spruces, and owing to its dense branching it has been used as a shelter tree in margins.

Under average conditions its rate of growth and production is considerably less than that of common spruce and Sitka spruce. It may, however, be of value under the less favourable conditions.

Silver Firs (*Abies*).

In the past the various species of silver fir have not been much planted in this country except as ornamental trees. This has been due, in part, to a destructive aphid pest, *Dreyfusia Nüsslini*, a species of the family Chermesidae. Common silver fir (*Abies pectinata*), *Abies grandis*, and *Abies nobilis* will be briefly considered.

Abies pectinata.

This species is a native of Central Europe. There are large forests of it in the Vosges Mountains and in the Black Forest. It appears to require a deep, moist, fertile soil, and is sensitive to late frosts and drying winds. It shows good growth on the west coast of this country.

After the canopy closes this species is a fairly rapid height-grower and produces a very heavy volume of timber. The timber is almost as good as that of spruce. This species should be given a careful trial, and experiments should be made to determine how the *Chermes* pest can be met. Some other species of silver fir appear to be relatively immune from attacks. The following are the most promising.

Abies grandis.

The habitat of this species is the west coast of North America from North California to north of Vancouver. There is evidence to indicate that this species is fairly safe from *Dreyfusia Nusslini*, but this should be confirmed by careful experiments. It has not been planted extensively enough in this country to test its growth and the value of its timber, but it does not appear to be much inferior to common silver fir in these respects.

This species may also be useful for underplanting.

Abies nobilis.

This is also a west North American species, and appears to be practically free from *Dreyfusia Nüsslini* also. A much less destructive species, *D. piceae*, occurs in it.

Abies nobilis has shown remarkable growth in several parts of the west coast, and also on dry sandy soils on the eastern side of the country. When it begins to bear cones the weight of these often damage its crown. The timber, when green, is practically useless, but when carefully seasoned it is almost as

good as that of common silver fir. The seasoning of timber is a question which affects all our conifers, but especially the softer timbers.

Douglas Fir (*Pseudotsuga Douglasii*).

Douglas fir was introduced into this country almost a century ago. There are, however, only a few plantations even 50 years old. This species is widely distributed in western North America, viz. from a latitude of about 55° north through all the Rocky Mountains system to southern New Mexico, Arizona, and northern Mexico, and from the eastern base of the Rocky Mountains to the Pacific. Its distribution, however, is not continuous, there being areas from which it is absent. With such a wide distribution under different climatic conditions, it is fairly certain that there are different races of this species. Up to the present two varieties have been recognised in this country.

1. The Green Douglas or Oregon variety. This is the principal variety planted in this country, and may be taken as the form found under the best conditions of soil, rainfall, and temperature, such as near the sea-level in southern British Columbia, Oregon, etc.

2. The Blue Douglas or Colorado Douglas. This is the form found in the southern extremity of its range where the rainfall is much less.

This is no doubt a very rough division, and the growth of Douglas fir under various conditions in its habitat should be investigated. Should there be a hill type in the Rocky Mountains it might be more generally useful in this country than the typical lowland type.

For this tree to attain a height of, say, 100 feet in 50 years a deep and fertile soil is necessary. It would, however, compare very favourably with other species if a height of only 70–80 feet was reached. This may be possible on relatively poor soil. In the opinion of the author experiments should be made to determine the rate of growth and production of Douglas fir on relatively poor, thin soils such as, at present, frequently carry an indifferent crop of Scots pine. The different races should all be tried under such conditions. There is sufficient evidence to suggest the experiment, and even though it was a failure there would be no great loss, while, if it was a success,

it would greatly extend the area of land economically afforestable. The same applies to water supply. Moist soil and humid atmosphere undoubtedly increase the growth of this species, but we should attempt to determine its minimum requirements as regards these factors. Swampy conditions are unfavourable. It is fairly certain that a considerable degree of shelter is necessary, especially from drying winds, otherwise the branches turn red and die. Douglas fir grows up to 5000–7000 feet above sea-level in the Rocky Mountains, and there appears to be no reason why we cannot grow it up to elevations of 1500 feet provided ample shelter is available. It is already giving good results in this country at elevations of 1000 feet above sea-level. In its early life it is liable to damage from late and early frosts, but any available nurse, such as birch, will greatly lessen such damage.

Until its requirements are fully investigated, this species should only be planted on fairly fertile, deep, moist soils, with ample shelter and with an aspect other than S.E., in order to mitigate against frost damage.

Under favourable conditions this species gives remarkable results as regards height-growth and production. At 50 years a height of 80–100 feet and a volume-production of 5000–7000 cubic feet can be expected. The Blue Douglas is much less productive, but, nevertheless, it may compare favourably with other species under the less favourable conditions.

The timber of Douglas fir is very variable in density, quality, and thickness of sapwood even in its habitat. At its best it approximates to larch but is lighter. In America the timber is used for all kinds of construction, sleepers, etc. The timber of this species grown in this country requires careful testing both mechanically and in use under different conditions.

The earlier woods of this species planted in this country were in most cases a mixture with larch, as at Taymount in Perthshire and Llandinam in Wales, or with spruce, as at Gairloch in west Ross-shire. The larch was rapidly killed by the Douglas so that the latter species grew up under fairly open conditions. Even when planted pure as at Tortworth, Glos, the planting distance was wide, namely 12–15 feet. Later, the other extreme was reached. It was planted pure and dense, in some cases 3 feet apart. Douglas fir is a rapid grower throughout life, but especially in early life. When planted 3–4 feet apart

the struggle for existence becomes too intense at a very early stage. A thinning made then is non-productive, while if the wood is left alone its future management becomes very difficult, for the formation of a good root-system is impeded and the crowns become too small. There is a danger of wind and snow damage which increases when a thinning is made. It is almost certain that the minimum planting distance for this species is 6 feet. Under some conditions a considerably wider distance may be desirable. There is no evidence that Douglas fir will clean itself of its branches naturally, whatever the density of planting. It is better to plant fewer plants and use the money thus saved to prune the best trees when 15–20 years old.

Owing to its rapid height-growth, Douglas fir is, *par excellence*, a species which should be heavily thinned. It gives promise of being the conifer which will enable us to obtain the largest size of individual tree in the shortest possible time. This must be one of the objects of forestry in this country, as most of our big timber has been used for war purposes, and it should be replaced as soon as possible. Experiments should be made to determine how this can be best done. Sufficient dominant trees of satisfactory shape could be selected when the first thinning is made, and these favoured by the removal of the other trees in subsequent thinnings. To obtain the best results, it may be necessary to break the canopy permanently.

Douglas fir is a most valuable conifer, and investigation should be carried out to determine what are its minimum requirements as regards soil, water supply, etc., and how it should be tended to produce different results, such as maximum quantity production, largest size of individual stem, and the best quality of timber.

From this brief discussion of our conifers, it will be seen that we have much to learn regarding them. There is no place for dogma at this stage of the development of forestry. All engaged in it should acquire an enquiring mind. There is a great need for extensive and imaginative experimental work carefully carried out and sanely interpreted. We should not limit ourselves to that alone, however. Research is no mystic and awesome ritual, it is largely the accurate determination of cause and effect. All engaged in forestry should be researchers.

What is of equal importance is to see that all the experience that is gained is not only made available to all but used by all. For instance, what is the use of determining that Sitka spruce is the best species on certain peats, if we continue planting Scots pine there? Research should not only be encouraged within the industry; it should be regarded as essential to its continued progress.

8. A Note on the Financial Results of Pine and Beech Forests in Normandy.

By A. D. Hopkinson.

While serving on the staff of the Directorate of Forestry, the writer came into close contact with the French Forest Service in northern France, and it was through the courtesy of certain of the French forest officials that he was enabled to obtain the information on which the present article is based.

The object of the article is to illustrate the difference between the material and financial yield of a conifer grown on a medium rotation and a deciduous hardwood grown on a long rotation. As the value of both timber and money at the present period is in a very fluctuating condition, it was deemed best to base the comparison on both pre-war prices of timber and pre-war rate of interest, especially as the object in view is not to demonstrate the actual yield of either species so much as to compare the two. To us in this country who are about to embark on fairly extensive schemes of planting, the actual yields of certain species grown upon the Continent is probably not so interesting as the relation of the yield of one to the yield of another, because, although the actual yields would probably differ from our results, the proportion existing between the two might be expected to remain fairly constant.

Of the final yield of the two trees under discussion—Scots pine and beech—when grown in pure high-forest, we have certain knowledge in this country, but in regard to the intermediate yield or product of thinnings we have but little data, whereas in the State forests, from which the writer obtained the information on which this article is based, accurate records of both final

and intermediate yields have been kept for several generations past.

With regard to Table A, which gives the material and financial yield of an acre of Scots pine (*Pinus silvestris*) grown on a rotation of about 80 years, it is necessary to note that the figures given represent the actual average results obtained over considerable areas and not "normal" results as given in yield-tables. The forest from which the figures were obtained is situated on the banks of the river Seine, and varies in altitude from about 100 to 250 feet above sea-level; the soil is sandy, overlying a calcareous formation. The customary method of formation is assisted natural regeneration on the shelter-wood system, which accounts for the yield-figures at the age of 75 and 80 years. The forest is very conveniently situated for the purposes of disposal of produce, being on the outskirts of a very large industrial city, and is well supplied with metalled roads. The timber produced is clean and well grown but probably of lower average diameter than similar-aged pine in Great Britain. The cost of formation is taken at £1 per acre, and the annual expenses (including supervision but not administration) work out at 2s. per acre in excess of annual receipts.

Table B gives the yield in material and money of an acre of beech (*Fagus sylvatica*) grown on about 190 years' rotation. Here again the figures represent the actual results of practice and are not comparable with "normal" yield-tables.

The forest in question is situated about 15 or 20 miles from the city previously mentioned and clothes the upper slopes of chalk hills. It is for the most part conveniently situated with regard to railway facilities and well served by roads, and contained prior to the war some of the finest pure beech "stands" in France.

Natural regeneration on the Compartment or Shelter-wood system is the method of management, and the cost of artificial assistance to the young crop is estimated at 10s. per acre.

The annual expenses per acre after deducting the sporting rent amount to about one shilling, but this again does not include the costs of administration but covers such expenses as maintenance of forest roads and wages of forest guards.

TABLE A.—SCOTS PINE (AVERAGE QUALITY), YIELD FOR ONE ACRE.

Age	Timber			Poles			Firewood			Total Value	Age
		Rate	Value	Stacked	Rate	Value	Stacked	Rate	Value		
	Cub. Feet	Pence	Shillings	Cub. Feet	Pence	Shillings	Cub. Feet	Pence	Shillings	Shillings	
10	...	...	...	...	...	...	...	...	...	...	10
20	...	...	...	...	...	...	...	...	...	...	20
30	...	...	...	280	5	116	280	2	43	159	30
40	...	...	...	560	5	233	210	2	35	268	40
50	140	11	128	770	5	320	210	2	35	483	50
60	280	11	256	770	5	320	210	2	35	611	60
70	420	11	385	770	5	320	210	2	35	740	70
75	4200	11	3850	280	5	116	1400	2	233	4199	75
80	770	11	705	...	...	...	280	2	43	748	80

Soil Rent = £1, 9s. 6d. per acre per annum.

Table B.—Beech (average quality), yield for One Acre.

Age	Timber—1st Class			Timber—2nd Class			Poles			Firewood			Total Value	Age
		Rate	Value		Rate	Value	Stacked	Rate	Value	Stacked	Rate	Value		
	Cub. Feet	Pence	Shillings	Cub. Feet	Pence	Shillings	Cub. Feet	Pence	Shillings	Cub. Feet	Pence	Shillings	Shillings	
10	...	...	...	...	...	...	...	..	...	..	...	...	...	10
20	...	...	...	...	...	...	...	...	...	...	...	...	...	20
30	...	...	...	...	...	...	...	...	...	350	2	58	58	30
40	...	...	...	...	...	...	140	4	47	280	2	46	93	40
50	...	...	...	...	...	...	280	4	93	280	2	46	139	50
60	...	...	...	...	...	...	350	4	117	350	2	58	175	60
70	...	...	...	...	...	...	420	4	140	210	2	35	175	70
80	...	...	...	...	...	...	490	4	163	168	2	28	191	80
90	...	...	...	140	8	93	420	4	140	140	2	23	256	90
100	...	...	...	154	8	102	350	4	117	126	2	21	240	100
110	...	...	...	168	8	112	336	4	112	112	2	18	242	110
120	42	12	42	140	8	93	322	4	107	98	2	16	258	120
130	56	12	56	140	8	93	308	4	102	84	2	14	265	130
140	70	12	70	140	8	93	294	4	98	84	2	14	275	140
150	112	12	112	112	8	75	280	4	93	70	2	12	292	150
160	126	12	126	112	8	75	266	4	89	70	2	12	302	160
170	126	12	126	126	8	84	252	4	84	70	2	12	306	170
180	616	12	616	490	8	327	840	4	280	210	2	35	1258	180
190	7040	12	7040	1400	8	930	1960	4	653	490	2	82	8705	190

Soil Rent = 6s. 6d. per acre per annum.

From the above tables several points will be noticed. Firstly, from a purely financial point of view it will be seen that the pine is nearly five times as advantageous as the beech. But the difference in the length of rotation must not be forgotten. One hundred and ninety years for beech is a very long rotation and overreaches the culmination point of the mean annual increment by many years, whereas probably the maximum mean annual increment of the pine about coincides with the rotation.

Further, it should be noted that if the rate of interest were increased it would affect the financial return of the beech more adversely than the pine, but if the rotation of the beech were somewhat reduced the financial aspect of the crop would improve. It must, however, be remembered that beech is a crop which requires a considerable period in which to carry out the process of natural regeneration, and the length of the rotation must inevitably be longer than is necessary for pine.

Secondly, from the point of view of national economy, beech, on this long rotation, means a very much larger quantity of timber stored per acre, which has the advantage of providing a large reserve which may be called upon in times of emergency such as war. However, it is necessary to offset against this the lower general utility of beech-wood as compared with pine-wood for military purposes.

It must also be noted that the pine is, year in year out, producing more timber per acre (in the proportion of about seven to six), and is consequently employing more labour in its felling, conversion and working-up.

Still another point in this connection must be borne in mind, and it is one to which the French Forest Authorities attach considerable importance. Beech-wood forms the raw material of certain industries, and therefore, as its import in large quantities would be difficult and costly, it is esssential that it should be produced at home. Pine, on the other hand, can, in normal times, be imported easily and in large quantities at a moderate price, and consequently, it is argued, that it is not such an essential species for home production as beech. This is probably quite true, but the argument does not wholly apply, as a great deal more beech timber is produced in northern France than is absorbed in those industries for which the wood

is particularly suited, and in consequence it is employed for many purposes where pine would be more appropriate.

Furthermore, the importance of beech-wood—particularly that derived from early thinnings and branches—as fuel should not be forgotten, and for this purpose pine is but a poor substitute. This, however, has little importance in this country where firewood scarcely pays to sell.

Thirdly, the question has to be considered from the silvicultural point of view, and here the greater advantage certainly lies with the beech, which as a pure crop has many advantages which cannot be assigned to extensive areas of pure pine.

In conclusion, it may be worth while noting that although the information contained in the two tables was procured from different forests, there was abundant evidence to prove that pine would grow as a pure crop just as well in the most unfertile and exposed parts of Forest "B" as it did in Forest "A."

9. Variation in the Scots Pine (*Pinus silvestris*, L.).

By J. M. Murray, B.Sc.

From the points of view of utility, hardiness and ease of adaptation to environment, the Scots pine is one of our most important forest trees. It is also our only indigenous conifer of first-class dimensions, and abundant evidence exists in the peat-bogs that it formerly covered a large part of Scotland. In this area, although geographically comparatively limited, it grew on various kinds of soil and under different climatic conditions. Plants, as a rule, are more or less plastic, and in adapting themselves to varying environments may give rise to numerous locality forms. It is entering on debatable ground to state whether these acquired characters are or are not hereditary. Certain observers believe, on the basis of experiments, that they are heritable, but others are sceptical. Apart from changes induced by environment, slight, or even considerable variations (mutations) are always liable to occur in any type or original form of plant. Intervarietal and interspecific crossing may also make its mark. These variations and crossings have been taking place throughout the ages in plants, and the type may now be obscured by the abundance of varieties, or be hidden in the geological records, or have disappeared

altogether. In common with other plants Scots pine has been subjected to these changes, and it is now a matter of great difficulty to say what were the characters of the original form. Variations mentioned in this note are to be taken as divergences of broad groups of trees from each other without reference to a type form.

In Scots pine the shape of the cones and the appearance of the apophyses is a common form of variation, and varieties have been named on this character alone. Variations also occur in the needles, habits of stems and twigs, types of bark and colour of the staminate flowers.[1]

In our native pine woods it is possible to find trees bearing cones whose apophyses scarcely protrude (form *plana*, H. Christ.), as well as trees bearing cones with apophyses which show all the varying grades of protrusion, even up to those with slightly or distinctly reflexed hooks (approaching form *reflexa*, Heer). The last-named form is often found on crippled trees growing under xerophytic conditions, but it is not confined to these alone. Trees bearing cones near the *reflexa* type have been found by the writer on well-grown trees in the native woods and also in one of the finest planted woods in the south of Scotland. In this planted wood trees with cones of the *plana* and *reflexa* types grew alongside each other, towering to a height of about 90 feet, with stems and crowns showing no practical and constant differences.

Variation in the needles generally shows itself in the length, breadth, degree of glaucousness and duration. These are characters which, in the same species, are to some extent influenced by the environment and robustness of the trees. Very short needled forms (*parvifolia*, Heer) are not at all common.

Of all the characters the stem form and branching are technically of most importance. In Scotland mention is often made of pine of the Mar, Rannoch, Strathspey and other forests, indicating that in any one of these woods the mass of the stems and crowns is supposed to show characters distinct from what is found in others. Differences in the timber are also claimed, and the Rannoch man will assert that timber from the Black

[1] Klein describes these variations as "Lusus" (or sports), and names several sorts. He also names several forms that originated owing to environmental factors.

Wood is superior to that from any other forest. Others praise the length and straightness of the stems in their favourite forest, and so on. Different forms there would certainly appear to be, but such are to be found wherever Scots pine is grown over any considerable area. Several races or forms which reproduce true to seed have been distinguished and named. Of these races, possibly *rigensis* and *Haguenensis* (named after their places of origin) are the most famous, and Vilmorin, in his experiments at Les Barres, found the former to be the finest stem producer of all the kinds he tried.[1] It is not possible to say without extended and critical examination and experiment whether or no the forest forms which we recognise in Scotland belong to distinct physiological races. The exact determination of a race can only be demonstrated by cultures. In each of these native woods, however, many variations in form and habit occur. Thus, one can find in Loch Tulla wood trees with narrow crowns and long, clean stems of moderate diameter growing alongside coarse, branchy trees of large diameter but short bole. At Loch Maree trees with weeping branches occur alongside horizontally branched specimens.[2] Branchy trees and those with clean stems could be found in Glen More. In Glentanar the growth forms are very numerous, even in the part about the natural origin of which there should be little doubt. Similarly, differences in form and habit can be noted in any of the other native woods. The appearance of the bark is not more constant, and trees with relatively thin, orange-red bark coming far down the stem grow alongside those with thick, large tabular-scaled, brown or greyish bark with only a small amount of the thin, red bark showing near the top and on the smaller branches.

In planted woods it is also possible to pick out variations. An instance of this was given by Mr A. S. MacLarty in the last number of the *Transactions*. I am indebted to Mr MacLarty for specimens of the trees he described and have been able to confirm his observations on the bud characters. I can now give the following characters based on these specimens and on others in my possession. The lettering A and B refers to the plants of Mr MacLarty's paper.

[1] Elwes and Henry, *Trees of Great Britain*, vol. iii. p. 596.

[2] Witches' Brooms are not uncommon on pine branches, but they are more numerous on trees in Loch Maree forest than anywhere else in my experience.

Buds.—A has a decided covering of resin showing on the adpressed scales, while B has little or no resin covering on the scales, which are free at the tips and somewhat recurved with fimbriated edges.

Colour of the shoots.—B is decidedly warmer than A in colour. The bark of the 2-year-old twigs of A is citron with distinct greyish-green markings, while B has twigs russet coloured with faint greyish-green markings.

Leaves.—A has longer and slightly more glaucous needles than B. The margins of the needles in both forms only show fine serrations. Microscopic examination shows no distinct and constant differences in cross-sections.

It is of interest to note that, in 1811, G. Don of Forfar read a paper on "Varieties of *Pinus silvestris*."[1] In this he stated that he had, in 1810, observed that there were at least four varieties of Scots pine. One of these (No. 2) he thought might be raised to specific rank and named *Pinus horizontalis*. His first variety was the one he considered of least value as a forest tree, seeming "to be but short-lived, becoming soon stunted in its appearance, and it is altogether a very inferior tree to varieties 2 or 3." The characteristics he gave were that the branches formed a pyramidal head, "the leaves being marginated," "dark or full green" in colour and "but little glaucous"; cones elongated and "tapering to the point." The bark of the trunk was rugged.

He stated that No. 2 (his *Pinus horizontalis*) was distinguished from No. 1 by its horizontal branches, which tended to bend downwards. "The leaves are broader than in variety 1 and serrulated," lighter coloured and more glaucous. The bark was less rugged, and the cones were thicker, smoother, and not so pointed. He conjectured "that the fir woods which formerly abounded in every part of Scotland, and the trees of which arrived at large size, had been of this variety or species." (Var. A above resembles this form in many ways.)

His third variety was said to have lighter coloured leaves than No. 2, "approaching a silvery tint." The branches formed a head like variety 1. Its cones had "the appearance of being beset with blunt prickles bent backwards." The leaves were serrulated. "This variety," he said, "is more common than No. 2, and it is also a good tree." He only found three or four trees of the fourth variety, and he described these as

[1] Published in *Memoirs of Caledonian Horticultural Society*, vol. i., 1814.

having the leaves "somewhat curled or rather twisted and much shorter." Lambert had some time before published a description of *Pinus Banksiana*, and Don thought his No. 4 nearly approached that species.

These four forms (and we may add Don's "at least" to the number) can be found in plantations all over Scotland at the present day. This note merely touches the wide and interesting subject of which it is intended at some future date to give a larger and fuller account. The question is likely to be greater than it was in Don's time, since we have had over a hundred years of importation of seeds from the Continent, thus making it probable that we have in our plantations a large number of varieties and physiological races. Some of these may be of great value under our conditions, while others are likely to be practically useless. The matter is in need of very thorough investigation, since on the selection of proper parents for the units of our future pine plantations depends their success or failure.

10. Abstract View of Trees Planted by the Right Honbl. Fras. 10th Earl of Moray, from 1767 to 1810.

[With the Earl of Moray's permission we reprint the following interesting document which was engraved on copperplate early in the nineteenth century, and printed for private circulation.—Hon. Ed.]

At Darnaway, in the County of Elgin.

Species of Trees	Year Planted	Girth		Height		Number Planted
		Feet	Ins.	Feet	Ins.	
Oaks . . .	1768	3	9	40	6	1,114,260
Elms . . .	...	4	6	50		
H. Chestnut .	...	6	...	35		
Plane . . .	...	4	...	40		
Ash . . .	...	3	6	40	6	727,290
Beech . . .	...	4	6	46		
Larch . . .	...	6	6	70		
Spruce . . .	...	4	10	40		
Scots Fir . .	...	5	6	55	...	10,346,000
				Total at Darnaway		12,187,550

At Donibristle, in the County of Fife, and at Doune, in the County of Perth.

Species of Trees	Year Planted	Girth		Height		Number Planted
		Feet	Ins.	Feet	Ins.	
Oaks . . .	1767	4	4	50	...	476,400
Ash . . .	.	4	10	42	6	122,050
Elm . . .	...	3	7	53	...	112,320
Beech . . .	..	5	4	43	..	71,190
Plane . . .	...	3	7	40	. .	53,000
Birch . . .	...	3	6	45	...	30,500
Larch . . .	...	4	10	49	...	432,700
Scots Fir . .	...	4	9	45	...	832,540
				Total at Donibristle and Doune		2,130,700

Total at Darnaway . . .	12,187,550
At Donibristle and Doune . .	2,130,700
Grand Total . .	14,318,250

Remarks.

At Darnaway.

The Soil in general gravelly, the surface a black sandy mould, producing Whins and heath on the high grounds.

In the low grounds the soil is a little stronger, producing Broom and Juniper.

Situation from 100 to 500 feet above the level of the Sea.

Owing to the shelter of the oldest plantations the trees planted of late years make more progress than those which were planted at an earlier period.

Trees in the Nurseries at Darnaway and Donibristle from 1 to 4 years old

Oaks	100,000
Ash, Elm, Beech, Larch, &c. . .	200,000
	300,000

At Donibristle.

The Soil is various, viz.: gravel, clay, sand, sandy loam on the top of rotten rock and in some parts moss. Trees of every kind thrive in those soils, except in the moss, where the Scots fir and Birch succeed best. Oaks thrive well in the clay and loamy soil if moderately dry, also upon rotten rock.

Situation from 2 feet to 300 feet above the level of the Sea.

At Doune.

The Soil is a gravel mixed with a sandy clay, in which Oak, Larch and Scots fir grow well.

Situation from 100 to 400 feet above the level of the Sea.

The Girth and height were taken in the year 1807.

11. Aberdeen University Forestry Society.

The forestry students attending the University of Aberdeen, at a meeting held in the Forestry Department shortly after the opening of the winter session, decided to form a Forestry Society for the purpose of promoting the interests o restry, especially among those who are, have been, or intend to be students in forestry, by affording opportunities for the exchange of views on matters of importance, by means of lectures, discussions, demonstrations, or by any other means which may be deemed advisable. Office-bearers and a committee were appointed to assume the charge of the conduct of the society. A syllabus of lectures on subjects covering a wide field of topics relating to forestry has been prepared for the current winter session, and there is every indication that the society has a prosperous future in front of it.

The inaugural lecture to the society was delivered by Mr Peter Leslie, Lecturer on Forestry, on the 31st of October, on "The Prospects of Forestry." Mr Leslie at the outset congratulated the members of the society on the success which had attended their efforts in starting a Forestry Society, and said that no more suitable time could have been selected for such an event than the year that, among other important happenings, had witnessed the placing on the Statute Book of the Forestry Act, which if wisely administered could not fail to lead to forestry becoming an important rural industry.

He intended treating the subject of his paper first from its natural economic side, and then from those aspects of it which more particularly concerned students and lecturers. Three things were essential if forestry were to be placed on a satisfactory footing as an important industry:—there must be a sufficiently large area of land economically suitable for afforestation; there must be enough capital available for the

needs of the industry; and there must be a sufficient supply of labour of all grades of skill working under a capable administration.

The first essential was the land, and in order to arrive at an estimate of our potential resources in land it would be necessary to take account of the areas of land at present classified as rough grazing, or devoted to sport but better adapted for afforestation, which could be roughly estimated to be about 1,000,000 acres in extent, as well as of the areas of land already under forest. A number of years before the war the area under forest in Scotland was stated in the Board of Agriculture returns to be about 900,000 acres, but the forests were not more than 30 per cent. as productive as they would have been under good management, and the reason for this was chiefly that the management had not been intensive enough. When the returns from an enterprise did not accrue until after 70 or 80 years it was natural that owners should endeavour to keep down expenditure, and this was often done to an extent which impaired the productivity of the woods. In order to improve the productivity of our existing forests, and to increase the area under timber to a material extent, funds would have to be made available for promoting schemes of forestry, and the State was the only body which could be expected to furnish money on a large enough scale for practicable purposes. This was now clearly recognised by Parliament and the community at large, and by the Forestry Act a sum of at least £3,000,000 was earmarked for forestry purposes during the next 10 years.

Mr Leslie explained the Forestry Act at some length, and emphasised the fact that a considerable number of junior forest officers, skilled foresters and woodmen would be required for the carrying out of the planting schemes which were contemplated by the Reconstruction Sub-Committee in Forestry, on whose recommendations the Act was chiefly based. The problem of getting the right kind of foresters and a supply of labour would take some time before it could be satisfactorily solved. It was the intention of the Commissioners to set up a number of woodmen's schools in forest districts throughout the country, where apprentice foresters could receive instruction in practical forestry.

The number of men engaged in forestry would in time be

considerable. Assuming that in Scotland there would ultimately be about 2,000,000 acres of forest a labour staff of 20,000 men would be required, one man for each 100 acres as compared with one man needed for 1000 acres in sheep farming. Allowing for three dependants to each woodman this would mean a population dependent on the forests for their livelihood of 80,000 persons, but this estimate did not take into account the number of persons who would be engaged in the wood-manufacturing industries. One of the chief duties of the Commission would be to foster and stimulate the development of these industries, and there would ultimately come a time, if their efforts were successful, when the number of persons employed in wood-manufacturing industries would considerably exceed the number engaged in the tending of the forests. A long time must necessarily elapse before they could reach this stage, and the development of woodland industries depending on home timber must be a slow business at the best, but the industries already in existence which partly depended on home timber and partly on foreign timber would form a convenient starting-point for future developments.

The chief wood-manufacturing industries were at present localised chiefly in the large urban centres—the city of Aberdeen, for instance, was one of the chief wood-consuming centres in the United Kingdom and was the centre of thriving box-making factories and bobbin works, industries which would have to be developed and expanded—but with the increase in size of our forests it would be possible for similar industries to be started in districts at present thinly populated and situated at some distance from the urban centres. They could also hope eventually to see the starting of new industries, such as the erection of pulp-making factories, and of wood-distilling plants, in heavily-wooded districts.

The question might be asked how would their Universities and the Forestry Departments be affected by these developments. The Commission would insist on every man who wished to become a forest officer getting a practical training in forestry in addition to being well grounded in the scientific aspects of the subject. Students wishing to qualify themselves for such appointments, besides going through the course of study for a degree or diploma in forestry, would have to serve a two-years' apprenticeship in the forests connected with the woodmen's

schools, and the best of the men who started their careers in the woodmen's schools would be encouraged to attend the courses of instruction at the universities for the higher technical training provided at these institutions. The universities and colleges were at present severely handicapped in their efforts to supply the kind of technical instruction that would be most useful to the students afterwards, by lack of funds for the proper equipment of their Forestry Departments. The University of Aberdeen and the North of Scotland College of Agriculture were in a position to offer a good training in the fundamental sciences, and the students could also get a good training in silviculture, but there were other branches of forestry for which the necessary facilities were lacking. In some of the American universities provision had been made for Professorships or Lecturerships in lumbering, as well as in silviculture, and their example would have to be followed by the institutions in this country where the highest kind of technical instruction was provided, if their students were to be able to compete with the graduates of the American universities. In concluding, Mr Leslie spoke of the prospects open to the students as State foresters or foresters in the service of private landowners, and also dealt with the possibilities of nursery work as a business, as well as with the opportunities provided by the saw-milling or lumbering industry both at home and in the colonies. He stated that there would be good opportunities in the colonies for men with a thorough technical training in the different branches of forestry, including a knowledge of the working of saw-mills and the manufacture of timber.[1]

[1] A report of Mr Leslie's lecture, on which the above notes are based, appeared in the *Aberdeen Journal* on the 1st of November 1919.

12. Reports of the Swedish Forestry Research Institute. Nos. 13 14, 1916 1917.

By J. M. Murray.

These Reports fill two large volumes extending to 1301 pages of Swedish text, with summaries in German, English, and French, occupying 172 pages. The subjects dealt with are all of considerable interest. Although some deal with matters which are of most value in Sweden, still, even from these we, in Scotland particularly, can gather much information of use in dealing with our own special problems. Then, in connection with each subject there is given a fairly comprehensive list of literature.

The first report, by Nils Sylvén, gives particulars of the North-Swedish pine, *Pinus silvestris lapponica*, Fr. This variety of *Pinus silvestris* (Mayr gives it specific rank as *P. lapponica*) resembles very much the variety *engadinensis* (Heer) of the Alps. Some authorities have even classed these varieties together. Sylvén would appear to indicate that the agreement of the characters is not complete. He instances, among other things, the difference in colour of the ripe cones, *engadinensis* being more greenish-yellow and *lapponica* more straw or brownish-yellow. He also cites Engler's researches.

Gunnar Schotte gives the results of observations of snow damage in the woods of Southern and Mid Sweden. In this we find much material of interest, especially since he shows what classes of woods and trees are most affected, and how the method of management influences the amount of snow-break. As means of preventing serious damage the author, while advocating selection of races with short and small crowns, and those with drooping branches, use of seeds grown in the locality to be forested, and mixed woods, falls back on probably the surest of methods—early and strong thinning.

Hendrik Hesselman has done a large amount of work on nitrate-formation in natural soils. This work was carried out by three methods—testing the nitrifying power of a sample of the soil in a suitable solution of ammonium sulphate; the nitrification estimated in a soil sample preserved in an Erlenmeyer flask, and the nitrate content of plants. An elaborate account of the conditions in different types of wood is also given. The question of available nitrogen in soils is

an important one, and this report is a considerable addition to the growing stock of literature dealing with the subject.

In the second volume Gunnar Schotte gives about 300 pages of Swedish text to a report on "The Larch and its Importance in Swedish Forest Economy." This account deals so thoroughly with the larch—a tree of the first importance in Britain—that, if space permitted, long extracts would be made. It is curious to note how much the cultivation of larch in Sweden was dependent on our British, and particularly Scottish, pioneer work. This may be attributed to the fact that Swedish landowners came to Britain during the first half of the eighteenth century to study agriculture. Later, the advent of Germans into Swedish forestry brought about the introduction of German seed which gradually ousted that of British origin. The results were unsatisfactory, and, with the exception of Nilson, who studied larch in Scotland, Swedish foresters are inclined to be sceptical of the larch as a forest tree. Schotte considers this undesirable state has resulted from the introduction of unsuitable races. His opinion is that Silesian and Scottish seeds produce stems of straighter growth than those of Tyrolese origin. In his investigations, he placed the trees in classes, namely :—

As *c* trees those that are crooked and branchy (including the worst "wolf-trees"); badly forked and very crooked specimens are put in class *cc*.

As (*c*) are classed those with minor bends which would not have a serious effect on the timber.

In class *d* are placed trees damaged by their neighbours, while (*d*) includes trees in overcrowded patches, but whose crowns are not deformed.

Class *e* includes diseased trees, and *f* dead and dry trees. The last four classes are only of subsidiary importance, being products of methods of management.

In woods of Scottish origin only 1 per cent. to 6 per cent. of *c* and up to 20 per cent. of (*c*) trees were found. In those of Tyrolese origin 5 per cent. to 39 per cent. were *c* trees and 6 per cent. to 30 per cent. were (*c*).

In 1904, when this Society visited the Omberg Crown Park, the members were impressed by the fineness of the larch stems growing there. Not knowing that they were of "the Scottish race" an offer was made of some genuine Scottish larch seed for experimental purposes. The seeds sent were sown in 1905

alongside seeds of Tyrolese origin, and planted out in 1907. The average height-growth shows a slight difference, but "most striking, however, is the greater straightness of the Scottish larch." Of these, only 1·5 per cent. were *c*, and 10·3 per cent. (*c*) trees, "while the Tyrolese larch gave 31·5 per cent. extremely crooked trees (*c* and *cc* trees), and 19·5 per cent. less crooked trees (*c*)." Gunnar Schotte is of the opinion that the Scottish larch is not the product of 150 years' growth in Scotland, but that it is probably due to the isolation of a race "with hereditary good characters." This idea is probably correct if we consider mainly those larches which originated from parents on the Dunkeld estates. It is evidently from this source that the older Swedish larches came. The author also attempts to account for the presence of crooked stems in larch. These, he says, may be due to heredity or to direct injuries. Injuries caused by frost are indicated as one of the causes. This is, no doubt, true, but we incline more to the idea that the crookedness is often hereditary. When the leading shoot of the larch is lost and a side shoot takes its place, the result is more often an easily recognised "kink" than a decided bend. Nor can the wind always be blamed for the crookedness of stems.

After a full investigation the author comes to the conclusion that if larch is to be grown in Sweden it must not be from Tyrolese seed but rather from seed of Scottish or Silesian origin, or best of all from the straight-growing woods that exist in the country.

In Chapter III., E, the silvicultural characteristics of the larch are discussed, and an account is given of its productivity. The mixture of Scots pine and larch is often condemned, and it is rather interesting to note that the author considers this combination has advantages either in group or single stem mixture where the quality is good for pine (1·0—0·4). An admixture of 20 per cent. is considered advisable. He hesitates, however, to recommend the mixture of larch and spruce owing to increased liability to larch disease due to partial suppression and also to the attacks of *Chermes* which this mixture might favour. He rightly points out that the mixture of larch with pine or spruce can occasionally improve the financial return.

There are seven chapters devoted to different species of larch. A long account is given of the Siberian larch, which is evidently

of considerable importance in Sweden. So far as we have seen this species is of no forest importance in Britain. Damage by frost and canker has usually proved fatal to it. The Japanese larch is also given considerable attention. In Sweden it would appear to grow well but to be very productive of crooked stems. This is a defect which we find in many of our British plantations.

Hendrik Hesselman produces a long report "On the effect of our Regeneration measures on the formation of saltpetre in the ground, and its importance in the regeneration of Coniferous Forests" (English text). Reading from the English abstract this study would appear to have been mainly an investigation of the growth of the so-called nitratophilous plants. The question of nitrification is very important in regeneration measures, whether these are natural or artificial. The author states that even in the best coniferous forests little or no nitrification or nitrate formation occurs; the transformation does not appear to go further than the ammonia stage. Thinnings or fellings allowing a great access of light are said to make a radical change in the bacterial flora, and nitrification becomes more active. An exception is made where the covering is raw humus. In this case "there appears only a more active transformation of the humus nitrogen, but no nitrification takes place." The estimation of the nitrification can be done by means of nitratophilous plants. The presence of nitrate is said to induce the growth of raspberry, *Epilobium angustifolium*, *Arenaria trinervis*, *Galeopsis bifida*, etc. When this is lacking *Aira flexuosa* occurs. Working the ground so that mineral soil is mixed through the humus, rotting of trunks and brushwood, and burning are said to produce the formation of nitrate even in a markedly raw humus.

This paper is well worthy of perusal, but in reading it one must bear in mind the numerous changes which interference with the growing crop introduces. There is, for instance, not only an increased amount of light admitted, but, among other things, the air has freer play and the competition for water is lessened. (Fricke's experiments.) Under natural conditions the whole question is complicated by the many factors that come into play.

In addition to the foregoing, there are reports by Nils Sylvén on "*Melampsora* (*Caeoma*) *pinitorqua*," and by Ivar Tragarth on

"Insects injurious to spruce and pine cones," where he gives an ingenious numerical method of detecting parasites. Hendrik Hesselman deals with regeneration in the pine heaths of Norrland (introducing his nitrate investigations into this study). Gunnar Schotte deals shortly with the production of the aspen, while Sven Oden deals with the action of lime on sour humus.

On the whole the articles are mainly good, although in some cases they tend to be slightly wordy. They exhibit a practical striving after a knowledge of the facts that underlie certain forest phenomena.

13. Species of *Pityogenes* of Interest in Scottish Woodlands.

(*With Plates.*)

By James Fraser, B.Sc.

The beetles of this genus are widely distributed in Scotland, but on account of their small size and relative harmlessness, they have up to the present time attracted very little attention. It is well known that with altered conditions of surroundings, the economic importance of species, hitherto harmless, may increase. At all events, it is well to know our possible enemies, and to give some attention to provisions directed to curtail the possibilities of danger when general schemes have become accomplished facts, for then, in conjunction with other factors, these beetles may become a very real danger.

Their closest well-known relatives are the pine bark beetle, *Myelophilus*, and the elm bark beetle, *Scolytus*. With both of those beetles they have certain characters in common, both as regards structure and habits. The members of all three genera are bark-inhabiting insects; the antennae of all carry large club-like endings, and are similar in general form. The general shape of all three beetles is cylindrical, the tibiae are toothed, the tarsi are terminated by simple claws.

The two species of *Pityogenes* which have been described as forest-important are the two-toothed bark-boring beetle, *P. bidentatus*, Herbst., and the four-toothed bark-boring beetle, *P. quadridens*, Hartig. These are two valid species, and in each species varieties have been distinguished and named. Varieties have been distinguished according to the nature of the projec-

tions present on the elytra of the males, and according to the colour of the adult beetles, but there are certain constant similarities in details of structure.

The size of these beetles never exceeds 3 mm. The breadth is narrow in comparison with the length, and is uniform throughout the body. The thoracic shield is in all cases of the same width as the elytra ; the length of shield considered in proportion to the total length of the beetles is similar. The colour varies from yellow to dark pitch-brown; variations of all grades of colour may be seen in the beetles of one set of galleries. The antennae and tarsi of the different forms are yellow. The tibiae and femora are usually lighter in colour than the elytra. Hair is present on all parts of the body. The thoracic shield shows two distinct regions, a rough tuberculated front portion and a comparatively smooth hind region. The tubercles on the front region are flat-triangular; they point to the rear of the insect, and are arranged in a concentric manner. Smaller tubercles and hairs are to be seen between these larger triangular projections. The surface of the rear portion of the thorax is sunk below the surface of the rough front region. The heads of all the forms of *Pityogenes* are almost entirely covered from above by the thoracic shield; the head is in all cases almost spherical; the front part of the upper surface of the head carries numerous elevations, which show a concentric arrangement similar to that of the thoracic shield. The mouth-parts of all forms are very similar to one another, and do not differ much from those of other genera of the Family Ipidae. The rear portion of the elytra of the males is excavated so that there is a more or less circular impression; the characters by which the species have been defined are chiefly those of the males. The remarks that follow refer to males only.

Characters of the Wing-Covers of P. bidentatus, Hbst., and of its Varieties.

In the males of this type and in the males of the varieties of the type certain characters are common. The single wing-cover is hairy over the general surface, which is covered with small circular depressed areas; these latter are arranged in lines along the length of the wing-cover, and the depressions of any one line are more or less opposite to those of the second row on either side of it. They are found everywhere except on the

excavated surfaces: they are smaller and more numerous, however, on the rear portion of the wing-cover. The suture of the wing-covers is raised, and on each this raised inner boundary runs along the whole length. In the anterior two-thirds of the dorsal surface of the wing-cover there is a shallow furrow which runs below the raised inner boundary. This furrow widens out into a triangular depressed area distinct from the apical excavation already referred to. This area is of importance in connection with the position of the prominences which distinguish the several forms. A distinct line of hairs runs along the wing-cover within the raised inner boundary, and this line of hair is easily visible on the apical excavation.

The type of the species *P. bidentatus* described by Eichoff is that in which the only marked projection of the wing-covers is a single hook on each, placed on the outer boundary of the excavated apical cavity. The hook consists of a short heavy stem and a head shaped somewhat like a Lochaber axe. Two stiff bristles arise at the base of the hook, but when viewed from some directions they may appear to rise from the points of the head. The outer edge of the excavation below the large hook is rough and carries a number of small tubercles; hairs are associated with the tubercles. The number of tubercles is not constant, but four are usually easily seen; two of these are placed close to the tip of wing-cover and two are placed midway between the base of the hook and the tip of wing-cover. The tubercles do not appear to be all equally close to the edge of the excavation. The way in which hairs are associated with these is similar to the arrangement in the case of the hook.

A varietal form of *P. bidentatus* has also been described in detail. This variety has all the characters of the type already described, but it has in addition a second small hook placed on the true horizontal dorsal surface of the wing-cover and in the triangular depressed area already referred to as present in all forms. The shape of the second projection is quite distinctly hooked, and the tip of the hook is turned to the rear of the beetle. This second hook is not equally prominent in all cases where it occurs, and on account of the position in the triangular depression it is not quite so obvious as the greater. Its position relative to the first described hook is constant, as is the distance from the suture.

In the two described forms of males, the rough hairy outer

edge of the excavation gives one of the most reliable characters for distinction from the closely allied forms of *P. quadridens.*

Characters of the Wing-Covers of P. quadridens and its Variety.

The appearance of the surface of the wing-covers is similar to that of *P. bidentatus,* but the circular depressions are more numerous. The outer boundary of the excavation is smooth, not hairy; it does not carry tubercles, and it is rounded, not sharp and abrupt. The form described as the type by Eichoff is that in which there is present one large hook similar to the large hook of *P. bidentatus*, and in addition a small tooth placed lower down than the large hook on the outer edge of the excavation and on the lower third of the outer boundary.

A varietal form of *P. quadridens* has been named *P. bistridentatus*, Eichoff, which has, in addition to the projections of *P. quadridens*, on each wing-cover a small conical tooth placed in the triangular depression. The position of this small tooth is important, it is more distant from the large hook than the corresponding projection in the varietal form of *P. bidentatus;* its shape is not that of a hook. The outer boundary of the excavation is similar to that of the varietal form of *P. quadridens.*

Relative Frequency of Occurrence of these Forms in Scotland.

The four forms described above all occur in Scotland. A list is given below of places in which one or more of the forms have been found. The most common forms are *P. quadridens* and *P. bidentatus* var. The *bistridentatus* variety of *P. quadridens* is rarer but still not uncommon. The form described as typical *P. bidentatus* is rare.

Localities in which Pityogenes Species have been found.

Locality.	County.
Murthly.	Perthshire.
Fodderty.	Ross-shire.
Drumshoreland.	Linlithgow.
Kintore.	Aberdeenshire.
Nethybridge.	Inverness-shire.

Attention has been given to the similarities of the beetles of the four forms described. The differences existing between the two species *bidentatus* and *quadridens* are not all equally definite. The most definite characters are the nature of the

Piece of Pine branch, with bark removed, to show central pairing chamber and five mother galleries of *P. bidentatus*. From nature.

[*To face p.* 104.

Pine branch showing on outer wood pairing chamber and mother and larval galleries of *P. bidentatus*. From nature.

outline of the outer margin of the excavation (this has been described) and the size. *P. bidentatus* is always longer than *P. quadridens*. The difference of size is, however, made less conspicuous on account of the fact that the breadth of *bidentatus* is greater in proportion than is the breadth of *quadridens;* the former is therefore heavier in appearance than the latter. The average length of *bidentatus* male is about 2·7 mm.; that of *quadridens* is about 2·2 mm. Less definite is the difference of colour; I have not found the differences described to be very helpful. The flat projections on the thorax are more marked in *bidentatus;* generally *quadridens* is less hairy and lighter in colour than *bidentatus*.

Habit of Life and Host Trees of the Beetles.

Both species of the genus are polygamous. The male beetle bores into the bark of pine trees and hollows out a small irregular copulatory chamber in the sapwood, this chamber being well seen in the accompanying plates which are from photographs. A very common point of entry into the bark is, especially in the case of small twigs, below a branch whorl. Female beetles follow the male at a later date and proceed to tunnel mother-galleries, which radiate from the copulatory chamber. The number of mother-galleries may be from 3 to 7. These galleries are said to run in the sapwood when made by *bidentatus*, and in the bast only when made by *quadridens*. The mother beetles lay eggs in notches along the mother-galleries; from these eggs the larvae hatch and tunnel outwards from the mother-galleries. Both species may be found in branches varying in size from $\frac{1}{4}$–3 inches in diameter. The freshness of material required by the beetle varies within wide limits; it seems indeed to prefer material which is fairly dry. It is possible that the flow of resin in fresh material is not favourable to the insect. These facts are of some interest in considering possible danger from these insects. The variation in the size and freshness of material in which the beetles may breed may determine in what region of the stem the mother-galleries are cut; it does certainly determine the shape of the whole system of galleries. It has been noted above that a frequent point of entry is at a whorl of branches; it may happen in such cases that one or more of the galleries runs out into one of the side branches. It is common to find both species in the one branch;

the identity of gallery-system may in such cases be established by examination of the beetles. I have not been able to find a constant difference between the gallery-systems of the two species.

The host plants on which I have found both species were Scots pine. In those trees which had been felled or blown, but which still retained the withered needles, the insects were common. They were also common on branches that had been cut off the trees and had been lying on the ground for about a year. I have not found either species in young living trees, even in cases where young plantations adjoined blown areas and the beetles were common. Numerous cases have been recorded from Continental forests in which the *bidentatus* species had destroyed large areas of young pine, and there are also records of attacks on spruce. Attack on spruce only takes place when pine is not available. The genus *Pityogenes* has been classed as very dangerous by some authorities; how are we to regard it in our country? It might be argued that interference in existing conditions is not desirable or necessary. It is a sound principle to inflict loss on an enemy whenever opportunity presents itself, and the principle may be well extended to dealings with this doubtful neutral. Clean woodlands are desirable, and destruction of brushwood, if it removes food, removes also the beetles that feed on it.

Points of General Interest connected with the Genus.

In connection with breeding experiments which were commenced, it was necessary to collect adult beetles as they emerged from the galleries. It has been noted above that the number of females working from one copulating chamber may be as high as seven. The number of males emerging, in a new brood, was found to be about half that of the emerging females, which is at all events about double the number necessary. Does this fact show only another provision against possible accidents to the male during the period in which he seeks a suitable position for fresh breeding-place, or is it possible that two or more males may live in one gallery-system? I have not found on any occasion two males in a freshly-formed gallery-system.

I wish to thank Dr R. Stewart MacDougall for his kindness in lending books and material, and for his supervision of my observations.

NOTES AND QUERIES.

The Forestry Commissioners.

The following have been appointed as Commissioners under the Forestry Act, the qualifications being as given in Parliamentary papers:—

Lord Lovat (Chairman).—Owner of extensive woodlands and closely identified with forestry in Scotland. Director of Forestry, B.E.F., France. Member of Forestry Reconstruction Sub-committee and of the Interim Forest Authority.

The Right Hon. F. D. Acland, M.P.—Chairman, Home-Grown Timber Committee. Chairman of the Forestry Reconstruction Sub-committee. Chairman of the Interim Forest Authority.

Sir John Stirling-Maxwell, Bart.—Assistant Controller (Scotland), Timber Supply Department, Board of Trade. Honorary Secretary, former President, Royal Scottish Arboricultural Society. Member of Forestry Sub-committee. Will represent Scotland.

Colonel W. Steuart Fothringham. — Member of Interim Forest Authority. Assistant to Assistant Controller (Scotland), Timber Supply Department, former President of Royal Scottish Arboricultural Society. Identified with forestry development in Scotland. Will represent Scotland.

Lord Clinton.—Former President of English Forestry Association. Member of Interim Forest Authority.

Mr L. Forestier-Walker, M.P.—Will answer for the Commission in the House of Commons. Will represent Wales.

Mr T. B. Ponsonby.—Member of Interim Forest Authority. Identified with forestry in Ireland. Will represent Ireland.

Mr R. L. Robinson.—Member of Interim Forest Authority. Secretary, Forestry of Reconstruction Sub-committee. Formerly head of Joint Forestry Branches of the Board of Agriculture and Office of Woods. Distinguished career at Adelaide and Oxford Universities in pure science and forestry.

Timber Measurement: A Suggestion.

There is a well-recognised method of estimating timber on an area when number of trees, average timber-height, and average

breast-height measurement are known. The estimator recognises that by measuring a number of blown or felled trees in the area he can establish a relationship between the measured breast-height value and the value of any section at any point in the stem of the tree. The relationship can be established equally well for measurements of quarter-girth, diameter, or of girth. When, then, the average trees on which the estimate is to be based are standing trees, provided the taper or decrease of measurement per known length of stem has been obtained, and the values of timber-length have been determined, it is possible to reckon value of sectional area at half the timber-height. The volume can be reckoned then in usual manner. The procedure involves reckoning even in areas where taper is known.

Tables can be arranged to indicate directly the volume of any tree of known timber-length with certain breast-height measurement and with definite taper. These tables could be arranged for all gradations of taper, but it is possible that it would be found sufficient to have tables arranged for decrease in diameter of $\frac{1}{4}$, $\frac{1}{2}$, 1, $1\frac{1}{4}$, and $1\frac{1}{2}$ inches per 10 feet of "run" on tree. The idea is not new, and as it exists it may be of interest to attempt to develop it. Reliable form factors may require a long series of observations; it is equally true that a similar series would be necessary for taper estimates over wide areas. The taper in any one case can, however, be easily found, and the use of such tables then merely amounts to using a type of ready reckoner. It is obvious that the tables can be equally well used for all species. These tables could be used in any case where the timber-length was determined, and the size fixed as timber limit would not affect them.

In the specimen table that follows, volume is stated for trees of any breast-height diameter and of varying length when the trees show a decrease in diameter of 1 inch in a "run" of 10 feet. Breast-height has been taken as 4 feet from ground in order to facilitate reckonings. Table given is a skeleton one to show method only. It would be interesting to have remarks of readers.

Mr J. Rennie was kind enough to check my figures for the skeleton table given on next page.

J. F.

Diameter in Inches at Breast-Height of Standing Trees.

1 inch decrease of diameter per 10 feet "run."

Height in feet	6	7	8	9	10	11	12	13
10	1·90	2·66	3·40	4·32	5·34	6·48	7·72	9·08
20	3·18	4·46	5·98	7·70	9·64	11·80	14·18	16·78
30	3·93	5·70	7·80	10·20	12·96	16·02	19·44	23·16
40	4·24	6·36	8·92	11·96	15·40	19·28	23·6	28·36
50			9·50	13·00	17·00	21·60	26·7	32·4
60							28·92	35·4
70							30·24	37·38
80							30·79	38·56
90								38·88

	14	15	16	17	18	19	20
10	10·54	12·11	13·79	15·58	17·47	19·48	21·60
20	19·58	22·62	25·83	29·34	33·02	36·92	41·06
30	27·24	31·62	36·33	41·37	46·74	52·41	58·44
40	33·56	39·16	45·24	51·76	58·68	66·04	73·84
50	38·6	45·4	52·7	60·55	68·95	77·95	87·35
60	42·54	50·34	58·74	67·86	77·64	88·02	99·06
70	45·36	54·04	63·56	73·78	84·77	96·53	109·06
80	47·2	56·72	67·12	78·32	90·48	103·52	117·36
90	48·06	58·32	69·48	81·72	94·86	108·99	124·11

	21	22	23	24	25	26
10	23·82	26·16	28·60	31·15	33·82	36·59
20	45·4	49·96	54·74	59·72	64·94	70·38
30	64·8	71·46	78·48	85·8	93·45	101·46
40	82·12	90·8	99·92	109·48	119·44	129·88
50	97·4	108·0	119·1	130·8	143·0	155·75
60	110·76	123·18	136·2	149·88	164·22	179·16
70	122·29	136·36	151·2	166·74	183·12	200·2
80	132·08	147·68	164·24	181·6	199·84	218·96
90	140·22	157·23	175·32	194·94	214·38	235·44

	27	28	29	30
10	39·47	42·46	45·55	48·76
20	76·02	81·90	88·00	94·28
30	109·77	118·41	127·38	136·65
40	140·76	152·04	163·80	176·
50	169·1	182·95	197·35	212·3
60	194·82	211·14	228·06	245·7
70	218·05	236·74	256·13	276·29
80	238·88	259·76	281·52	304·08
90	257·40	280·35	304·38	329·31

Volume is stated in cubic feet true volume.

Observation on Timber Measurement Suggestion.

This basis for the computation of standing timber in mass has a world-wide use. The practitioner in France uses it extensively, as also does the "timber cruiser" in the Douglas fir forests of the Pacific Coast. Where accurate and reliable Volume Tariffs are not available, a wider use of this type of table is highly desirable. Thornton T. Munger of the U.S.F.S., in explaining the use of this theoretic method, says:—

"One type of table used by experienced cruisers on the Pacific Coast is based on d.i.b. above the root swell on merchantable height, and on the rate of taper per log. It is a theoretic table in that it is prepared in the office merely by assuming the required set of diameters and height, and a series of tapers, and then applying the corresponding scale (volume in feet, Board Measure) for each log in the tree. It presupposes, however, a uniform taper throughout the length of the merchantable stem, and this is not true to life usually; hence the table is theoretically slightly off. A table like this has very great advantages. It is a universal table in a sense, in that one table will do for all species. Its cost of construction is almost nothing. . . . However, since it is based on three variables, it would complicate tallying. . . . It also requires the exercise of nice judgment. . . . In short, a table of this kind cannot well be fitted in with our (U.S.F.S.) established methods of timber surveys."

A type of table which is widely used in Western and Central France is based on circumference breast-high, the merchantable tree length and taper.

"Experiments made on a large number of trees after felling have shown that the circumference taken at 1·50 metres (height of a man breast-high) from the ground, and rounded off to tens, must be reduced by the taper of from 10 per cent. to 25 per cent. to obtain the mean circumference at the middle point of the merchantable stem. The following proportions have been developed:—

"*A.* 10 per cent. to 12 per cent. for forest-grown oak; beech; ash; elm; hornbeam; lime; sycamore; plane; birch; aspen; alder.

"*B.* 15 per cent. in certain special cases.

"*C.* 20 per cent. for plantation poplars; grey poplars; and pine.

"*D.* 25 per cent. for open-grown poplars; pine; silver fir (elevation 1500 ft. to 3500 ft.)."

The writer has used the tables prepared under this method, and has found their results quite accurate. Again, however, experience and judgment must be called into play.

The writer, who has had a rather wide experience in the preparation and use of Tree Volume Tables, can see that the introduction of a more direct system of timber surveying in Great Britain, such as is incorporated in the suggestion of J. F., can only result in the efficient simplifying of the very unnecessarily tedious and complicated procedure at present in use.

After all, results are the thing, and tree volumes can be secured just as accurately, and certainly much more rapidly, either by the use of theoretic or True Volume Table.

The goal, of course, should be the presentation of a comprehensive set of General Volume Tables, equipped with all the collateral site class coefficients and utilisation factors.

L. M. E.

The Highland and Agricultural Society and Home Timber.

The Highland and Agricultural Society have done much in the past to encourage home forestry, and that they believe in the utility of home-grown timber is shown by their recent action in adopting a motion submitted by Sir Hugh Shaw Stewart and seconded by Colonel Carruthers of Dormont. Sir Hugh submitted that the committee which deals with the contracts for the erection of the showyard should direct the attention of contractors to the importance of using home timber, other things being equal. He said it was common knowledge that in some quarters there was a prejudice against home timber. Home-grown timber for the purpose in view was quite as good as any foreign timber. He desired that the products of this country should not be placed at a disadvantage.

The Pine Beetle (*Myelophilus piniperda*).

The damage done to Scots pine plantations by this insect is now well known, but one important aspect has probably been overlooked. The injury to lateral shoots on healthy-growing trees will undoubtedly aggravate the shortage of seed, in the vicinity of felled areas, where the lop and top has, for any reason, been allowed to form a breeding-ground for the beetle. That a serious loss in timber increment occurs, where a bad attack has taken place, has been admitted for some time, and the characteristic appearance of the crowns on the margin of a felling area is known to most foresters. But, while it is evident that a loss of foliage must react on the crop of cones, the writer is not aware of any literature on the subject.

After the recent heavy fall of snow (November 1919) had disappeared, a heavy litter of short twigs was observed on the floor of an area of vigorous-growing Scots pine, and as felling had been going on for the last two years on an adjoining area, it was not surprising to find that the pine beetle had been busy. The snow was unaccompanied by wind, and, being moist, clung to the close crowns for some days, the weight ultimately snapping the twigs where they had been weakened by the entrance-holes made by the beetle. The unusual feature was the number of twigs found with cones attached. One, two, three, and even larger clusters of mature (two-year) cones were observed, and even a few specimens of one-year growth were in evidence. A closer inspection showed that a slight attack of the beetle had taken place during the late summer months of 1918, not severe enough to prevent the maturing of the then one-year crop of cones, but sufficient to check, to a certain extent, the formation of the succeeding year's crop. This corresponds with the fellings that were being carried on, part of the adjoining area being exploited during the spring and early summer of 1918 and part at the same periods of 1919. It is evident that the later broods, hatched out in 1918, took to the crowns of the adjoining trees in the autumn, and returned to the new fellings in the spring and early summer of 1919, the bulk of the logs and brushwood of the earlier felling having been cleared by that time. That the beetles have returned to their old winter quarters in augmented numbers is apparent. Even if there is no further felling in the neighbourhood, a few years must elapse ere the

affected area regains its vigour. Any back-going, sickly trees, within the standing area, may serve as a breeding-ground, in the absence of better material, but the fact which ought to be remembered is, that small as the beetle may be its power of flight is by no means inconsiderable. G. L.

The Forests of British Columbia.

We have just received from the Canadian Commission of Conservation a large volume dealing with this subject. The book, which is well illustrated, contains among other things an estimate of the amount of standing timber in the province, descriptions of the various species of trees and the stands they form, as well as of the climatic and physiographic influences acting on the forest. The methods of administration and the forms of tenure are also described.

The whole book is of considerable value, although the part dealing with the forest trees of British Columbia is probably of most interest to the British forester, since some of the most promising of our recently introduced species are natives of that country. The descriptions given include particulars of the climatic and soil conditions under which these species thrive, the composition of the main stands formed by them, a general description of their volume production, and other matters. Particulars of the methods of logging, quantities sawn, uses and stumpage values are also given. The desire for more intense utilisation is great, but that is very difficult to attain. Insect enemies are dealt with by Swaine, but few fungus diseases have been described; in fact, forest mycological work has scarcely been done in the province.

We understand that persons who are interested may obtain copies of the book on application to The Commission of Conservation, Ottawa, Canada.

Forestry Propaganda in Western Canada.

According to the *Canada Lumberman*, during November last a car-load of information on forests and their products was to visit many centres in the Prairie Provinces. During the preceding months the car visited the forested sections of eastern Canada, and attracted much interest and attention. The

exhibits in the car were brought together and arranged by Mr Robson Black, of the Canadian Forestry Association. The car is the property of the Canadian Government railways, and was to be moved from point to point over the lines of the several railway companies operating in the western Provinces, under the supervision of an official of the Dominion Forestry Branch.

The exhibits were drawn from many different countries, including Canada, the United States, Great Britain, Germany, France, Scandinavia, Egypt, and Japan. Lectures were given by the men in charge of the car in the car itself, and also in halls in the towns visited, where every phase of the timber industry, from the planting of seedlings to the manufacture of all manner of wood products, was explained and, as far as possible, demonstrated. The car contained a miniature nursery of spruce and Scots pine seedlings.

Mr Robson Black, accompanied by a motion-picture operator, also addressed thirty public meetings in the Prairie Provinces between 14th October and 1st November. Mr Black found the public interest in questions related to provincial forest management strikingly intensified as compared with four or five years ago. Western Canadian Clubs, Boards of Trade, Bankers and Mortgage Loans Associations, and other representative bodies held luncheons and dinners in nearly all large cities in order to provide an opportunity to hear forest conservation addresses. At some of the evening meetings, in places like Calgary, Prince Albert, and Winnipeg, the attendance of men ran as high as 600.

The chief point in the addresses was an outline of the extent of the Prairie Province forests and their present wretched condition, owing mostly to unrestricted forest fires. Instead of an increasing variety of wood-using industries, the larger mills were giving up operations, and enormous areas—as, for example, 40,000,000 non-agricultural acres in Saskatchewan—were being turned into permanent wildernesses. The effect of burned forests upon irrigation was also discussed in detail and proved one of the hardest hitting points in the whole conservation argument. The industrial potentialities of spruce-growing lands, the need of provincial and dominion co-operation in debarring the annual fire plague, the value of tree-planting to crop production were other points treated by Mr Black. The Forestry Association is endeavouring to establish a resident

western propagandist, and to engage a children's lecturer. The latter would give his entire time to school addresses in all parts of Canada, and would make generous use of motion pictures. In this way scores of thousands of young men and women annually would become personally acquainted with the interesting truths of forest protection and the constructive handling of the natural resources. An appeal will be made for better financial support of the Forestry Association, which has a small Government revenue and a national membership of 10,000.

State Forestry in New Zealand.

The issue of the New Zealand paper called *The Dominion*, for 24th September last, contains the following interesting article:—

"Last session it was announced that it was intended to place the State forests under the control of a separate Minister, and in November last this intention was given effect to by the appointment of the Hon. the Attorney-General as Commissioner of State Forests.

"By section 34 of the War Legislation and Statute Law Amendment Act, 1918, statutory authority was granted for—(1) sawmilling and the purchase or hire of sawmills by the Government; (2) the State to purchase private lands for forestry purposes; (3) the setting apart of Crown lands as provisional State forests; (4) taking lands for forestry purposes under the Public Works Act; (5) limiting or prohibiting the export of timber from New Zealand; and (6) prohibiting the sale of or the granting of licences to cut or sell standing timber on public or private lands except subject to conditions to be prescribed.

"An area of about 1,800,000 acres has since been proclaimed State forests under that authority. Additional areas will be proclaimed as soon as the necessary maps are completed. It must be understood that the setting aside of provisional State forests is not a final reservation. As soon as the necessary arrangements can be made, the reserves will be inspected, and such lands as are found to be more suitable for settlement than for retention under forest will be made available for settlement. The total area of State forests and provisional State forests is now about 3,273,000 acres, but of this area a large proportion does not bear timber of milling value, and a proportion is treeless mountain land. Taking a mean between the proportion

of the forest areas of France and Germany, this Dominion should have an area of 13,300,000 acres under forest to satisfy present and future demands.

"As the dairy, fruit, and other industries which use a large quantity of white pine were finding it impossible to obtain adequate supplies, measures were taken through the Board of Trade to limit the export of this timber to 40 per cent. of the total production. This has met with strong opposition from localities where a large export trade has been worked up, but, on the other hand, the users of white pine in New Zealand have made strong representations that its export should be entirely stopped.

"Regulations have also been gazetted, limiting the quantities of other timbers which may be exported from New Zealand during the present year, and sawmillers have been notified that the quantities exportable will be further reduced year by year.

"In the plantations a total new area of 2800 acres was afforested, about one-third of the area having been planted by discharged soldiers. Arrangements are being made to employ a larger number of soldiers, but difficulty is experienced in providing both accommodation and trained supervisors.

"The Commissioner of State Forests has publicly announced that the forests of New Zealand must be henceforth utilised for the people of New Zealand, and that consequently the export of all classes of timber must be limited at present and cease wholly in the near future, and further, that on land not suited for settlement, only timber ripe for milling must be cut, and the growing timber conserved on all lands continuing as State forests. Against the policy so declared there has been considerable protest from certain districts where it is contended that the export trade already established should continue and be allowed to increase in volume.

"Applications have been invited by advertisement in England for qualified persons to fill the positions of Director and Assistant Director of New Zealand Forestry. Special education, training, and experience in forestry have been required as essential qualifications for any applicant.

"Under section 32 of the Finance Act (No. 2) of last year, authority was provided for raising £200,000 for forestry purposes over and above the £50,000 authorised under section 50 of the Finance Act, 1916."

REVIEWS AND NOTICES OF BOOKS.

Forests, Woods, and Trees in relation to Hygiene. By Prof. Augustine Henry. Pp. xii + 314 and 49 Illustrations and Maps. London: Constable & Co., Ltd. Price 18s. net.

Professor Henry states that the subject matter of this book was briefly dealt with in three Chadwick public lectures. His aim is "to interest the statesman, the student of economics, the engineer, the physician, and the layman, as well as the forester, in certain aspects of forests and trees, about which vague notions are prevalent."

The book is written in a somewhat popular manner, and contains a large amount of extremely useful information on the subjects dealt with. Prof. Henry seems to have taken considerable trouble in collecting from various sources what information is available on the hygienic effects of forests.

The main subjects dealt with include the sanitary influence of forests; forests as sites for sanatoria; trees in towns; afforestation of pit mounds; and over 200 pages on water catchment areas. Details are given of all the main catchment areas in Great Britain and Ireland. In dealing with these subjects, Prof. Henry gives full weight to the opinions against as well as those in favour of afforestation. Since the whole question is one which is not perfectly understood as yet, the value of the *pros* and *cons* is increased.

There is a certain amount of perhaps unnecessary repetition. Then in his own statements the author does not seem to accept the facts of experience. We find him, for instance, in the preface and on page 81, advocating the use of disbanded soldiers for planting, in spite of a later statement that Leeds Corporation found the cost of forming plantations was raised by about 50 per cent. and the failures were quite 30 per cent. when planters were drawn from the unemployed. On page 81 he states that disbanded soldiers accustomed to rural labour might be employed, but we do not think all soldiers who were rural workers are suitable for, or willing to become, tree planters. As Prof. Henry states himself, "planting trees is skilled work, and requires preliminary training."

We can agree that *Thuja gigantea* "is for so far a very healthy tree," but not that it is free from fungus attacks. We

have known of several trees being attacked and killed by *Armillaria mellea*. Nor is it correct to state that the only recorded case of disease on Corsican pine is an attack by a *Peziza*. The reference is to Hopkinson's article on *Dasyscypha calycina*. We are of the opinion that Tubeuf mentions in "Diseases of Plants" attacks on *Pinus Laricio* by *Peridermium pini*. The Corsican pine may also be damaged by the common root fungi. These errors may be due to a certain looseness of wording which seems to creep in here and there in the work. On the whole, however, the book is one of considerable value, and should prove of interest and use to the various readers for whom it is intended.

The Essentials of American Law. By J. P. KINNEY, A.B., LL.B., M.F. New York: John Wiley & Sons. London: Chapman & Hall, Ltd.

This work is by the same author as the book noticed above. It extends to 280 pages, has an elaborate table of contents and a useful index. The work also shows indications of painstaking research, the cases and reference notes at the bottom of the pages being very exhaustive. As American law is more akin to English than to Scots law, the book will not appeal to ordinary readers on this side of the Border, but will be of much interest to professional lawyers

The author begins with a classification of property, notes various forms of tenure of land, and then goes on to discuss the law of trees and timber, the question of "waste," trespass, and criminal offences. Then follow chapters on the subject of contracts in relation to growing timber; preparation, manufacture, and sale of timber products; transportation; the rights of mortgagees; the ownership of trees on boundary lines and highways and fixtures.

The book is printed in very clear type, and, like the preceding volume, is a good specimen of the kind of work issued by these well-known publishers.

OBITUARY.

Professor J. W. H. Trail, M.A., M.D., F.R.S.

We regret to record the death of Professor Trail, of the Regius Chair of Botany in the University of Aberdeen, which took place on the 18th of September 1919, after an illness of about three weeks' duration.

Professor Trail was born at Birsay, Orkney, on the 4th March 1851, and was the youngest son of the late Very Rev. Samuel Trail, D.D., LL.D., who was Professor of Systematic Theology in the University of Aberdeen from 1867 till 1887, and Moderator of the Church of Scotland in 1874. Professor Trail had a distinguished career at the University, taking his M.A. degree with highest honours in Natural Science in 1870, and M.B., C.M., with highest honours in 1876. In 1873, before he had completed his medical studies, he was appointed Naturalist to an exploring expedition in Northern Brazil, having even at that early period come to be regarded as a botanist and entomologist whose future was full of promise. On his return to Aberdeen in 1875, he resumed his studies at the University, graduating in medicine the following year. In 1879 he was appointed Professor of Botany in succession to the late Professor Dickie, at the comparatively early age of 26 years. He held this appointment up to the date of his death, his occupancy of the Chair extending over a period of 42 years. He was the senior member of the Senatus of the University.

His travels in Brazil provided Dr Trail with excellent opportunities of studying vegetable and animal life in the tropical forests of that region, and the results of some of his researches on the palms were published in a series of papers in the *Journal of Botany*. His knowledge of botany was extremely wide and thorough. He was regarded as an authority of the first rank on the fungoid diseases and insect pests that attack forest trees, while much of his work on field botany was of importance to students of forestry, because of its bearing on forest ecology. His familiarity with the country districts of Aberdeenshire, in conjunction with his biological studies, in course of time naturally led him to take an interest in aspects of forestry other than those with which he was

immediately concerned as a naturalist. He realised many years ago, indeed long before the importance of forestry was generally appreciated, the need for an enlightened forest policy, and the effects that its adoption would have in promoting the wellbeing of rural communities, especially in the North of Scotland. He was the person to whom the credit must be chiefly assigned of having foreseen the necessity of making provision for forestry education in connection with the University of Aberdeen and the North of Scotland College of Agriculture. The Forestry School at Aberdeen was established in 1908, and was at first housed in the Botany Department of the University. From the date of its establishment until his death, he continued to take an interest in the work of the school, and his advice and friendly counsel were constantly in request by the lecturers.

Professor Trail became a member of the Royal Scottish Arboricultural Society in 1908, when the Aberdeen branch was opened. He was President of the branch for a period of two years, and was a very regular attender at the meetings.

He was a man of the most kindly disposition, and his memory will be revered by all classes of the community with which he was connected, and more especially by those who had the privilege of attending his classes. He endeared himself to his students, many of whom occupy important positions as botanists, entomologists, and foresters in Britain and in the Colonies, not only on account of his wide knowledge of his subject and the sound instruction which he imparted, but because of the kindly personal interest which he took in their careers. He was unwearied in his efforts to assist those of them whom he thought deserving of being helped, and never spared himself any pains or trouble to obtain for them the kind of appointments in which he thought they would be likely to render the most useful service.

In the death of Professor Trail we have lost a friend in the true interpretation of the word, while forestry has lost one who, by his enthusiasm, foresight, and experience, would have done much at the present time to advance its interests and ensure its success. P. L.

TRANSACTIONS

OF THE

ROYAL
SCOTTISH ARBORICULTURAL SOCIETY.

VOL. XXXIV.—PART II.

November 1920.

A. W. BORTHWICK, D.Sc.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

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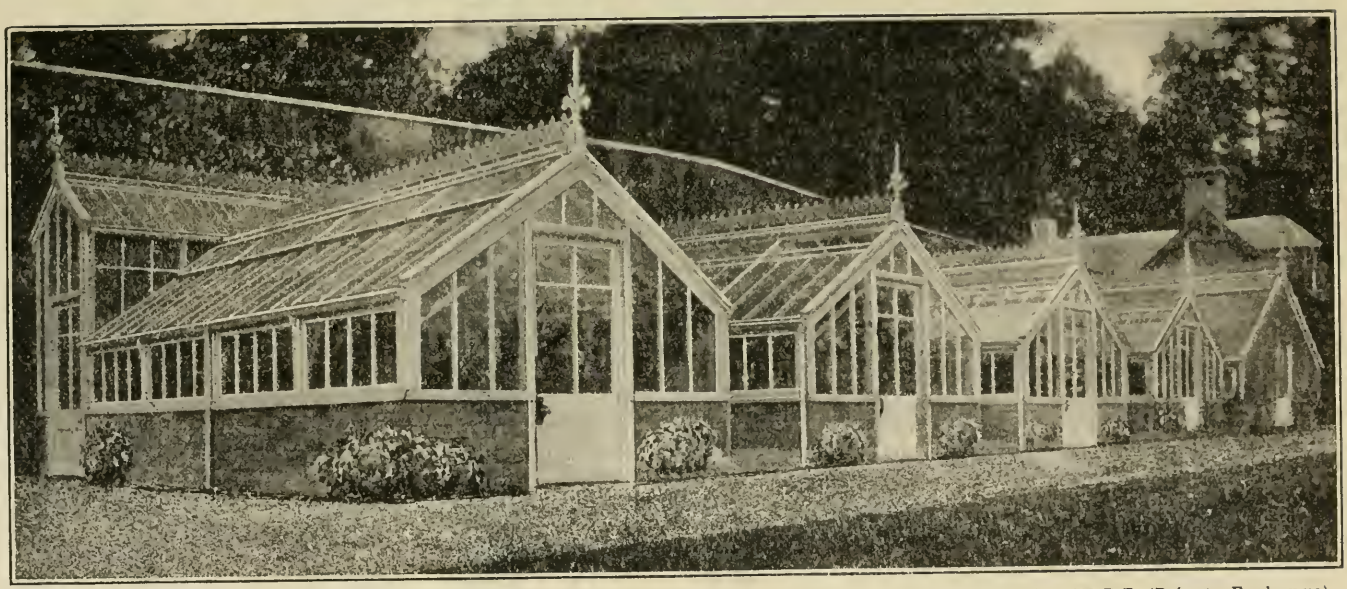

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Royal Scottish Arboricultural Society

MEMORANDUM regarding the Objects and Work of the Society.

Institution.

THE Society was founded sixty-six years ago with the object of advancing Forestry in all its branches. During that period it has expended in the interest of Forestry a sum of over £26,450, including about £600 towards the expense of founding the Chair of Forestry in the University of Edinburgh.

Membership.

Any person interested in Forestry and desirous of promoting the objects of the Society is eligible for membership.

Lines of Effort.

The work of the Society in the past has been carried on mainly along educational lines, by holding meetings for discussions, lectures, etc.; by publishing *Transactions*, which contain all the most recent and most important information relating to Forestry; by interviewing Ministers and pressing the claims of Forestry on successive Governments; by making silvicultural Excursions at home and abroad; by organising Exhibitions of Forestry throughout the country; by granting medals and prizes for Essays; and by affording to Members, through its Honorary Scientists, gratuitous advice on subjects relating to Forestry.

Education.

In recent years progress has been made in providing facilities for education, but the various courses of instruction could be much improved and added to, and a State Demonstration Forest has not yet been provided. A Degree and Diploma in Forestry for Forest Officers can be obtained at the Universities of Edinburgh and Aberdeen, and a Diploma in Forestry for practical foresters at the West of Scotland Agricultural College, Glasgow, but meantime no Diploma is obtainable at the Agricultural Colleges at Edinburgh and Aberdeen. Schools of Practical Forestry have been opened by the Government at Birnam and Beauly, and others are promised in suitable centres.

Suitability of Conditions for Afforestation.

All the experts—both home and foreign—agree that the soil and climate of Scotland are eminently suited to tree-growth, and are capable of producing timber of such quality and in such quantity as would make the country, to a very considerable extent, independent of foreign supplies.

Woodland Area and Its Value.

Previous to the war, the woodland area of Scotland—due solely to private enterprise—was only 868,000 acres. Of the whole land area of the United Kingdom only 4 % was woodland,

being the lowest percentage in Europe with the exception of Portugal. Small and unimportant as this area appeared to be, it was found of inestimable value in connection with the war. The growing stock of mature timber is nearly exhausted, and it is imperative that it be replaced and greatly added to if national safety in the future is to be assured. The care of the young plantations which have survived the war is also of the greatest importance.

Imports.

The annual value of the imports of timber and timber products into the British Isles previous to the war was about £40,000,000, and about 80 or 90 per cent. of timber imported was coniferous. A considerable proportion of this might be grown in this country, where huge tracts of land could be more economically occupied in growing trees than as at present, and healthy occupation thereby provided for a much larger rural population, of whom a proportion would be small-holders, reaping the benefits of both forestry and agriculture.

Agreement as to Need of Afforestation.

All parties are agreed that it is the urgent duty of the State to undertake Afforestation on a large scale, either directly or indirectly in co-operation with landowners, to whom every encouragement should be provided by means of loans and grants, adjustment of taxation, etc.

The Society's views on the Development of Afforestation were asked by the Forestry Sub-Committee of the Reconstruction Committee, and the statement prepared by the Council and adopted by the Society was subsequently printed as an Appendix to the Sub-Committee's Report, which was issued in the beginning of 1918. An Interim Forest Authority was set up soon afterwards with a grant of £100,000 to make preliminary arrangements for Afforestation, and a Forestry Bill was subsequently introduced into Parliament to give effect to the recommendations of the Reconstruction Sub-Committee. Some anxiety was expressed in regard to local control under a Central Authority for the United Kingdom, but the Council received ample assurance that the policy of the Government and of the Forest Authority is to arrange that all the executive and administrative work shall be done, so far as Scotland is concerned, under the control of Scottish Officers with Headquarters in Edinburgh. The Bill became law as the Forestry Act, 1919, in August, and came into operation on 1st September of that year. The Forestry Commission has been appointed and has began operations.

In these circumstances it is very important that this Society should be in a position to assist effectively in directing schemes along right lines. The membership already includes a great number of men who are recognised authorities on Forestry, but it is desirable that it should include every one in Scotland who is engaged in producing, converting, or utilising timber, or who is otherwise interested in the subject, so that the influence and usefulness of the Society may be further increased.

ROBERT GALLOWAY, S.S.C.,
Secretary and Treasurer.

8 Rutland Square,
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Royal Scottish Arboricultural Society

I desire to become a member of the Royal Scottish Arboricultural Society.

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[CONDITIONS OF MEMBERSHIP, see Over.

CONDITIONS OF MEMBERSHIP (excerpted from the Laws).

III. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible for election as an *Ordinary* Member in one of the following Classes:—

1. Proprietors the valuation of whose land *exceeds* £500 per annum, and **others**, subscribing annually . . One Guinea.
2. Proprietors the valuation of whose land *does not exceed* £500 per annum, Factors, Nurserymen, Timber Merchants, and **others**, subscribing annually . . Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and **others**, subscribing annually . . . Six Shillings.
4. Assistant-Foresters, Assistant-Gardeners, and **others**, subscribing annually . . . Four Shillings.

IV. **Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.**

V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums:—

1. Large Proprietors of land, and **others**, . . . £10 10 0
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VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.

XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

8 Rutland Square, Edinburgh.

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The Society does not hold itself responsible for the statements or views expressed by the authors of papers.

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

14. Report of the Annual Meeting, February 1920.

The Duke of Buccleuch, President, who was in the chair, said:—"Gentlemen, before proceeding with the business on the agenda, I have a special function to perform. You are aware that Mr Galloway has now completed twenty-five years as secretary of the Society, and, as members, you are also aware that the Society has prospered in an unexampled way since he became secretary, and I think I am quite correct in saying that it is still prospering. This is largely due to the fact that the Society has had as secretary, undoubtedly the best man it could have had to fill the office. I need not give you figures. You know how our membership has increased from year to year, and how the exhibitions at the Highland Society Shows, the excursions, and all the activities of the Society have developed.

"A small committee was formed to approach and to ascertain the views of the members as to a suitable method of expressing our thanks and of showing our esteem for our secretary. A most gratifying response was received from the members, not only those resident in this country, but also those in the Dominions and France, which shows that it is not merely in this country but all over the world that his efforts are appreciated. The committee ascertained that Mr Galloway would like a microscope, and as that did not anything like take up the whole of the subscriptions a suitably engraved piece of plate has been added, and the remainder is in the form of a cheque. I now present these to Mr Galloway, on behalf of the members of the Society, as a small token both of our personal friendship towards him and also of our appreciation of his successful efforts in promoting the prosperity of the Society. May he long continue to do so, and have himself long life and prosperity."

Mr Galloway in reply said:—"My Lord Duke and fellow members of the Royal Scottish Arboricultural Society, I really do not know how to thank you all for your kindness to me to-day. It has always been a great pleasure to me to work for this Society, and although the work has not been always easy, it has upon the whole been exceedingly pleasant. If it had not been so, and if I had not been associated with so many excellent friends, I doubt if I could have carried on so long as I have done. I am glad to-day that I have been able to hold on, because we have come to a period in the history of our Society which sees the commencement of what we hope will be great developments in forestry. To-day we are able for the first time to welcome in our midst representatives of the new Forestry Commission. I am sure that we all hope the Commission will be successful in the work they have undertaken, and I think we can assure the Commission that the members of this Society will give all the assistance they can.

"With regard to these gifts I should like to convey to those who are absent, as well as to those who are present, my most sincere thanks for these tokens of esteem, and of appreciation of my work. I feel honoured and gratified to know that contributions have come from all parts where our Society is known.

"I find on looking up the figures that at the time of my appointment, the actual date of which was 23rd January 1895, the membership of the Society was about 500, the funds amounted to £70, and the annual income was something like £200. There had been a deficit of £12 in the previous year. The surplus in the following year was £80, and from that it has grown to those substantial balance sheets we present from year to year. I have now begun my second twenty-five years, and I have no intention of giving up so long as you are satisfied with me. I thank you all most warmly."

The Secretary then read the report of the Council.

Mr A. D. Richardson.—"There is no reference in the report to a matter which I brought before the Council in connection with the payment for contributions to the *Transactions*."

The Secretary said that the matter had been before the Council but had not yet been disposed of.

Professor Robert Wallace.—"There is one point which I think should be noticed, it refers to the diploma in forestry, and

has apparently not been before the Council. The Universities give a degree in forestry, and the degree ought to be the highest stamp of education in forestry in the United Kingdom. The question arises whether a diploma is really necessary in addition to a University degree. The Universities would, I am sure, be only too pleased to strengthen the position of that degree, if it is possibly not good enough, but to start a diploma in competition with the University degree, as was done by the Agricultural societies some years ago, is, to my mind, a step in the wrong direction. I am quite certain a great deal of injury has been done to the cause of agricultural education, by the so-called Agricultural diploma, as a means of gaining what was regarded as a University distinction. I do not know whether the case is beyond remedy, but I am quite sure that similar diplomas in competition with the University degrees must do harm rather than good to forestry.

Mr Richardson.—"There is another matter in connection with the *Transactions*. I have not seen the last part, which is not yet issued, but in the July part most of the articles are unsigned articles. Now, there is a notice at the top of the table of contents, which appears in every part, that the Society does not hold itself responsible for statements of views expressed by authors of papers. What is the position in regard to those articles which are not signed? The longest article is a very pungent review of a book to which eleven pages are devoted, but the reviewer's name does not appear. I remember once sending a review of a book at the request of the Honorary Secretary, and it was thrown back to me because it was too severe, though my name was attached to it. Here is a far more pungent review, and the sum and substance of it is that the book is not worth anything. If it is not, surely two or three lines were sufficient, instead of spending the funds of the Society on a thing which very few people have much interest in. But who is responsible for it? We are all made responsible for these things if they are unsigned, and the bulk of the articles in this part are unsigned. I think if an article of that sort is put in the writer should put his name to it."

The President, in formally moving the adoption of the report, said that the points raised would be taken up by the Council afterwards. In regard to the question raised by Professor Wallace, his own view, and he believed the view of the Council

also, was that the University degree and the Forestry diploma were not necessarily antagonistic. The matter had been considered by the Council but there were great difficulties, as forestry education was in such a transitional stage. However, the Council would take into consideration what had been said. As regards the remarks made by Mr Richardson, he did not think the Society held itself responsible for the views and statements of contributors to the *Transactions*. The question of payment for contributions had been under consideration. It was not thought desirable to adopt the method, but the matter might be considered further.

The President also expressed his appreciation of the amount of time the Council had devoted to its work during his tenure of office. He himself and the Council felt it to be desirable to have all districts and all interests represented, and every endeavour was being made to achieve that end.

The President then referred to the appointment of the Forestry Commissioners under the Forestry Act, and drew attention to the fact that Scotland was strongly and numerically well represented. In regard to the exhibition at the Highland Society's Show in the Meadows, it was quite the best the Society had had, and Sir John Stirling-Maxwell and the others who took a great deal of trouble over it were amply rewarded by the keen appreciation shown, not only by members of the Society, but by the general public. It was a great revelation to many people.

The President then formally moved the adoption of the report.

Mr James Whitton, in seconding the motion, said that the exhibit which was staged in Glasgow, in connection with the Key Industries Exhibition, created as much interest as any other section of the exhibition. It was very gratifying to note the interest that the artisans of the city took in the exhibits. The number of questions asked, the intelligent criticisms offered, and the general appreciation of the kind, quality, and uses of timber indicated that we should endeavour to make such exhibits more popular and accessible to the classes who are interested in wood-craft.

Mr Massie submitted the Abstract of Accounts, which showed that the whole finances of the Society were in a satisfactory condition, and he moved its adoption. The motion was seconded by Mr Whitton, and the report was adopted.

Mr Charles Buchanan, in a few well-chosen words, moved

that the President be re-elected. He said that no one had conducted the affairs of the Society with more ability and success. It was due to the President's initiative that so large an increase had taken place in the Life membership of the Society, and they were all very grateful to the President for the work he had done in the past.

Mr Massie said he had the very greatest pleasure in seconding this nomination for the Presidency. The members had had two such successful years with our President that they were delighted to look forward to another.

The motion was unanimously approved.

The President in accepting re-election said:—"It is very kind of you to ask me to occupy the chair for another year. I believe it has been customary for the President to occupy the post for three years; I am not quite certain if two years is not long enough. I have been fortunate in seeing considerable developments in forestry during my period of office, and I can only say that the work has been exceedingly agreeable, because the Council have not only been very business-like, but they have been so pleasant to deal with, and, like the Secretary, have always helped me on every possible occasion. I have much pleasure in accepting your invitation."

Mr Robert Allan reported on the arrangements which were being made for the Forestry exhibit at the Highland Society's Show at Aberdeen. He was able to state that the Nursery and Plantations Competitions would be revived in the Aberdeen Show district.

Mr Charles Buchanan, Convener of the Excursion Committee, was able to report that the Council had decided that the excursions be resumed. He said that travelling facilities and hotel accommodation in their present abnormal state made it necessary to avoid any great distance. France had been mentioned, but on further consideration it was finally suggested that the excursion should be held in Wales, where many interesting places and phases of forestry were to be seen. He also reported that an endeavour would be made to arrange, if possible, that the time would be adjusted so that members who so desired could proceed to London to see the Imperial Forestry Exhibition which was to be held there.

The President said:—"The Excursion Committee thought a favourable time would be early in July, so that members could,

if they so desired, visit the Timber Exhibition in London, but the Committee always liked to have the views of the members. Perhaps no one has any objection to having the excursion somewhat earlier than in the past. If so, is it your pleasure that the excursions be resumed, and that we instruct the Council and its Sub-Committee to make the necessary arrangements?"

This proposal was agreed to.

The President then moved the following resolution on behalf of the Council:—

"The Royal Scottish Arboricultural Society, in Annual Meeting assembled, desires to put on record its appreciation of, and warmest thanks for, the great services to Forestry rendered by the following in connection with the passing of the Forestry Act, 1919, viz.:—

1. The Right Hon. F. D. Acland, M.P., Chairman of the Sub-Committee on Forestry of the Reconstruction Committee, Chairman of the Interim Forestry Authority, and Member of the Forestry Commission.
2. The Right Hon. Lord Lovat, K.T., D.S.O., etc., Member of the Sub-Committee on Forestry of the Reconstruction Committee, Director of Forestry with the Forces in France, Member of the Interim Forestry Authority, and first Chairman of the Forestry Commission.
3. Sir John Stirling-Maxwell, Bart., Hon. Secretary and Ex-President of the Society, Assistant Controller (Scotland), Timber Supply Department, Member of the Sub-Committee on Forestry of the Reconstruction Committee, and Representative of Scotland on the Forestry Commission.
4. Colonel W. Steuart Fothringham of Murthly, etc., Ex-President of the Society, Assistant to Assistant Controller (Scotland), Timber Supply Department, Member of the Interim Forestry Authority, and Representative of Scotland on the Forestry Commission.
5. Mr John D. Sutherland, C.B.E., formerly Member of the Board of Agriculture for Scotland, having charge of the Forestry Department of the Board, Director of the Home Timber Committee, Assistant Director of Forestry with the Forces in France, Member of the Sub-Committee on Forestry of the Reconstruction Committee, and Assistant Commissioner for Scotland under the Forestry Act.

The Society further desires, on the recommendation of the Council, to confer upon Mr Acland the Honorary Membership of the Society, in recognition of his successful discharge of the very onerous duties which devolved upon him in connection with the promotion of the Forestry Bill and its passage through Parliament."

He said:—"I do not intend to say very much in moving this, because I believe that Colonel Fothringham is going to speak on behalf of the Commissioners, and we will be very glad to hear any information he has to give us. It was thought desirable that the Society be asked to express its appreciation of the efforts of those gentlemen who brought about the formation of the Forestry Commission. Of course it had been a matter of debate in the past as to the best way in which this should be done and there was much difference of opinion, but I think now that the Forestry Bill has become an Act of Parliament and has passed into law, we are all at one in the object of making it as great a success as possible, and also I think of having as much done in Scotland as possible, because we rather flatter ourselves we are a little better off than other countries in having suitable land. Whether that is so or not we still remain of that opinion.

"There has been a great deal of work and trouble in preparing the Bill and getting it through. It has not been such plain sailing as some people think. Apart from the needs of forestry there are always a good many opposing interests, and it was very difficult to get a unanimous decision. But when you come to a unanimous decision in a large committee it means that certain members have had to give way. The result has been the Bill was presented to Parliament and has now passed into law. The first on this list in the resolution is Mr Acland, who was Chairman of the Sub-Committee on Forestry of the Reconstruction Committee. You met him here. He was good enough to come down and meet us. I do not think that prior to the war he had taken a very great interest in forestry, therefore he is an independent man as regards any preconceived ideas on the subject. He worked very hard both at the Timber Supply and also for forestry, and I think all those who worked with him admit that it was largely owing to his exertions that the report was adopted by the Government and passed into law. All the other members to whom it is proposed to give a vote of thanks are already, and have been for a very long time, members of our

Society, and also, as you know, very energetic members. The work they have done was only what we would expect they would do, and far the best thanks they can get is the knowledge that their efforts have reached a successful termination. That, I make certain, would be all they want, but we thought it would be a graceful act on the part of this Society if we were formally to move, as I now move, this resolution, although it is perfectly well known to them what our feelings are as regards the work they have done. Mr Sutherland, particularly, we all know has done a great deal for forestry in the past, and I know I can speak for myself that anyone who had dealings with him at the Board of Agriculture knows that his extreme courtesy and fairmindedness made matters easier than they might have been otherwise. I do not think I can say too much, on behalf of the Society, as regards his services to forestry and in other ways for the country. It is suggested that Mr Acland be made an Honorary Member of this Society, and we have reason to know that if this proposal is sanctioned he would very much appreciate the honour. It is the best compliment we can pay him, and I am sure his colleagues on the Commission, and those who belong to the Society, would agree that it is probably the most appropriate way to recognise his services. Therefore, I beg to move the resolution that the best thanks of the Society be given to the gentlemen named, both for what they have done to further the views of the Society, and still more for what we think they are going to do for the good of the nation in general and Scotland in particular."

Mr Whitton seconded, and the motion was carried unanimously.

Colonel Steuart Fothringham of Murthly, member of the Forestry Commission, then addressed the meeting. He said:—"Last year when the Interim Forestry Authority was in existence, you were good enough to listen to a few words I had to say then, and I have been asked to speak again this year on behalf of this Forestry Commission. First and foremost, in my own name and in the name of the various gentlemen mentioned in the resolution, I have to thank you very much for the kind expression of your feelings and for the resolution you have just passed. It has been part of the business of the Forestry Commission to keep in touch with the arboricultural societies in England, Scotland and Ireland, and I think it is distinctly an

advantage that this Society should be so well represented on the Commission as it is, for one of the Commissioners for England, Lord Clinton, is a member of this Society, and the Assistant Commissioner for England and the Assistant Commissioner for Ireland both happen to be Scotsmen, and I think both are members of this Society also. So Scotland is quite well represented on the Commission, and no doubt the interests of Scotland will be kept well to the fore by somebody amongst all this number. When I spoke last year I ventured to make a small prophecy which was not fulfilled, so I do not propose to make any more prophecies. They are rather dangerous things. I said at that time it was hoped the Act of Parliament would be very quickly passed, and we would soon have the Commission at work. That was in February, 1919. The Act of Parliament was not passed till some time in August, and in order to carry out the Act it was necessary to nominate Commissioners, and the Commissioners were not absolutely appointed till about the end of November, so there was nobody to carry out the Act, and the Commission could only be said to have begun its work at that time two and a half months ago. So the time has not been very great for getting anything done. But a good deal has been done, because the Interim Authority did a good deal of spade work, and got things into such a position that the Commissioners were able to start very quickly. I do not think I need put before you what has been done in England, because that will, no doubt, be dealt with by the English Commissioners. The fact is that until the beginning of December the Commission were not in a position to acquire or to rent any land. Certain preliminary arrangements were made, but those could be carried no further. Still, though nothing could be done until December, I believe we shall get a few hundred acres planted this coming spring. The negotiations for the purchase or hire of the land, by feuing or in other ways, for starting State forests have been carried on in a great many of the counties in Scotland—from Inverness-shire, Aberdeenshire and Argyllshire, to Berwickshire and Roxburghshire—and the Commission are in a position of having practically concluded a bargain for some 16,000 acres of land, and further negotiations are in active progress. The amount of preliminary work to be done in preparing the nurseries for subsequent plantings is very considerable, and the number of seedlings that the Commission have got at the present moment in Scotland is

about 40,000,000. So that with any luck, if we get our land transactions carried through and the seedlings are not hurt by the frost, we hope to get a good deal of land planted in the course of the next few years. The beginnings of forestry are slower than the beginnings of many other businesses. Then as regards schools, we started a school of forestry at Birnam for apprentices. It was started particularly under the auspices of the Employment Ministry, and all the men who went there it was insisted must be more or less disabled soldiers, so that limited our choice of men very much indeed. But we hope there are not going to be any more disabled soldiers for a very long time, and when they have been trained their places in the school will be available for forestry apprentices who have not been soldiers and not disabled. It is intended to start several more of these schools of practical forestry, so that it will be possible for young men who wish to advance in forestry to get training facilities at these training centres without very great difficulty. The men working at Birnam have turned out very well, and have done very good work.

"Among the activities of the Commission, as settled by the Act of Parliament, are various ways of getting planting started. The State will acquire a certain amount of land by purchase, feu, or lease, or in some other way, for planting to form State forests. The larger the blocks the better, but there are also schemes under consideration to encourage private proprietors to do a certain amount of planting. The fact is the principal aim of the Forestry Act is to get trees planted and timber produced in this country, whether by State forests or private individuals, and there are certain forms of encouragement such as proceeds-sharing schemes, loans, or grants, but unfortunately when the Forestry Reconstruction Committee made their report all the estimates were based on pre-war prices of plants, and labour and materials of all kinds. We all know that these prices are now quite out of date, and the amount of money voted will not go nearly so far as it was hoped when the report of the Forestry Reconstruction Sub-Committee was drawn up. All that can be done is to try to get the very best results from the money available, some £3,500,000, which is to be spread over ten years. It does not leave a very large amount for helping or encouraging the private planter. But none the less we hope private planting will go on, and, owing to the higher prices timber is fetching at

present, that it will give a reasonable return to those who carry it out. Planting has been begun. A few trees have been put in. It has as yet been a bad planting season in certain places, but we have been able to make a start. The same applies to England, and by a curious coincidence the first trees were planted in the South of England—Devonshire—on the same day as in the North of Scotland—Aberdeenshire—so both countries started exactly level. We can only hope the Forestry Commission will be able to produce some results. If what we have done in two and a half months may be taken as a criterion, I hope we will be able to produce some satisfactory results before the period of our office expires."

The Chairman.—"Might I ask whether the figures you gave—16,000 acres and 40,000,000 seedlings—apply to Scotland or the United Kingdom?"

Colonel Fothringham.—"To Scotland only."

The Chairman.—"We are very much obliged to Colonel Fothringham."

This concluded the business.

15. Report of Annual Excursion.

Six years have passed since the Society held its last annual excursion in 1914. On that occasion the meeting was of an international character, in celebration of the Society's diamond jubilee year. Much has happened in the forestry world during the years that have elapsed since then. Planting has been more or less at a standstill, while many of our finest mature and middle-aged woods have fallen to the axe and saw to provide material of vital necessity to the nation in her hour of need. In the present year the resumption of the excursions has coincided with the holding of a conference in this country, among imperial forestry delegates from all parts of the British Empire. It cannot be too often repeated and emphasised that the concensus of opinion among all foresters, whether home, imperial, or foreign, is that this country is eminently suited for the development of forests on an economic basis.

The selection of the district in which the excursion took place was a happy choice, and the arrangements, made by Mr Galloway, the secretary, and Mr Young of the Forestry

Commission, were such that the programme was carried through without a hitch.

Shrewsbury was the headquarters of the meeting, where accommodation was found for the entire party. From this centre, Powis Castle, Leighton Hall, Lake Vyrnwy, Kerry woods, Llangollen, and Vivod were visited.

Most of the members arrived in Shrewsbury on the afternoon of Monday, the 21st June. Mr Forrest, author of *The Old Houses of Shrewsbury*, who proved a very instructive guide, conducted the party to a number of the old and interesting buildings for which the town is famous. The Quarry Gardens, with its fine avenue of lime trees, were much admired from an arboricultural point of view.

On Tuesday, the 22nd, an early start was made by motor-buses to Welshpool, and the morning was spent in the Powis Castle grounds. The party were met by Mr J. Edmunds, the estate agent; Mr Campbell, assistant agent; and Mr J. Landers, head forester. In the deer park some very fine specimens of oak, sweet chestnut, Douglas fir, cedar, and Jeffrey's pine were seen. The champion oak, *Quercus pedunculata*, girths 24 feet at breast-height, its main trunk divides up into a number of massive limbs, the top of the crown reaches to 105 feet, and the quarter-girth content over bark is estimated at 2000 cubic feet. Another magnificent specimen, the giant oak, has a cubic content of 1900 feet. A Spanish chestnut was seen at Shepherd's Cross. It rises to a height of 80 feet with a clear bole of 47 feet, and carries a quarter-girth of 30½ inches at middle height, over bark measurement. Two Douglas firs, with 429 cubic feet and 390 cubic feet respectively, were seen, also a cedar of Lebanon which girthed 16 ft. 4 ins. at breast-height, and a specimen of *Pinus Jeffreyi* 130 feet in height which contained 270 cubic feet of timber.

On leaving the park the party re-entered the buses and were taken along the upper boundary of spring coppice, where some first-class oak were seen. A section of this wood, 14 acres in extent, was sold in 1917. It contained 429 oaks, 3 elms, 1 sycamore, which together totalled 21,000 cubic feet. The crop was about 102 years old and yielded a final return of £243, 10s. per acre.

After lunch at the Bungalow, where a fine view of the Castle and the surrounding country was obtained, a plantation with

a northern exposure, consisting of Douglas fir and Japanese larch on the lower slope, with Corsican pine and beech on the upper slope, was visited. The plantation was formed in the early days of the war, and is doing well. The terraced gardens surrounding the Castle were also visited and much admired. Before leaving Powis Castle Mr Charles Buchanan, convener of the Excursion Committee, proposed a hearty vote of thanks to Lord Powis for the privilege he had accorded the Society. He also, on behalf of the members, expressed their appreciation and thanks to Mr Edmunds and his staff for the excellent arrangements they had made to ensure the success of the visit. In replying, Mr Edmunds said that Lord Powis had intended to receive the party himself, but had been prevented by important business in the House of Lords.

The excursion was continued in the afternoon to Leighton Hall, the residence of Captain J. Murray Naylor, who, accompanied by his agent, Major Frederick, and the head forester, Mr T. H. Alexander, received the party on its arrival at the home farm. A start was made along the Wellingtonia avenue, planted between 1853-60. On arrival at the park a large number of fine specimens of exotic conifers was seen. In the Wilderness a fine specimen of *Cedrus Deodara*, 65 years old and 100 feet high, was inspected. In the Greenwood, a grove of *Sequoia sempervirens* of remarkably fine growth forms a striking feature. The trees are 60 to 65 years old and have attained a height of 110 feet. A number of trees of the same species in the more exposed margin of the wood were blown down in 1915, and the way in which the stools had thrown up abundant coppice shoots attracted much interest and attention. *Sequoia sempervirens* is one of the few conifers which possess this property. Among the more recent plantations the western and European larches had attained a height of 9 feet at 8 years old; Sitka spruce, two plantations, 10 and 11 years old, had respective heights of 12 feet and 18 feet; *Thuja plicata*, 11 feet in 11 years; Japanese larch, 12 feet in 10 years; Douglas fir, 18 feet in 9 years. Some of the plantations had been planted at a distance of $3\frac{1}{2}$ feet to 4 feet, but such close planting has now been given up on this estate owing to the danger from snow and wind break. At the Royal show in 1914 the estate was awarded, by the Royal English Arboricultural Society, gold and silver medals for the best and largest collection of

coniferous plantations, and a bronze medal for Sitka spruce.

In the audit room at the home farm Mrs Naylor kindly entertained the party to tea, after which the return journey to Shrewsbury was made.

The first day of the excursion demonstrated in a convincing manner the great possibilities that exist in Wales for the rapid and successful production of a large variety of high-class timbers.

On Wednesday, the 23rd, an early start was again made, the venue this time being Lake Vyrnwy, the Liverpool Corporation reservoir and catchment area. The catchment area lies in the county of Montgomery, and the total area of the Vyrnwy watershed is about 18,000 acres, the lake being 825 feet above sea-level. The rainfall varies locally from 50 inches to 150 inches. The climate is mild and humid, and free from extremes of temperature. The geological formation is Silurian sandstone and shales, which on weathering produce a yellow loam of good depth. Deposits of glacial clay on flat slopes are frequently associated with peat. The prevailing winds are westerly, and these to some extent limit growth, but in the more sheltered slopes the silvicultural conditions are excellent.

The planting scheme, as drawn up in 1913, contemplated the planting of a total area of 4000 acres in 20 years, and it is anticipated that the planting will be completed by the year 1932-33. The principal species to be grown are—Douglas fir, European larch, Japanese larch, *Thuja plicata*, Norway spruce, Sitka spruce, and Corsican pine. The common silver fir is being tried in favourable situations. Among the hardwoods beech and ash are to be included where silvicultural conditions are suitable. The Douglas fir is the most rapid grower, with the possible exception of the Sitka spruce and Japanese larch. Where shelter is sufficient it thrives well up to an elevation of 1300 feet. The European larch thrives well on the lower and middle slopes. The Japanese larch, though at first rivalling the Douglas fir in rate of growth, will not be used too extensively, in view of the fact that the well known and thoroughly tested European species shows such excellent growth. The Corsican pine gives every promise of satisfactory results on the drier exposed slopes. The Scots pine does not seem to be suitable

for the locality. The Norway spruce is doing well, especially in the moister places, and Sitka spruce will give equally good if not better results, especially on the upper peaty slopes. Beech grows well everywhere on the area except where the soil is too wet, and it will be used in appropriate mixture and placing as a protection against wind and fire as well as a soil improver. The ash is confined to the more sheltered spots and such small areas as are suitable for its requirements.

Generally the best sheltered slopes are reserved for Douglas fir in pure blocks, planted at 5 feet, but where the soil is moister 50 per cent. *Thuja plicata* will be added. On very wet or peaty sites Norway and Sitka spruce are used, planted at 4½ feet spacing. On moderately sheltered middle slopes larch and beech, in the proportion of 75 per cent. and 25 per cent., are planted at a distance apart of 5 feet.

The upper slopes and exposed dry ridges are reserved for the Corsican pine, either pure or in mixture, with 15 per cent. of beech. The remaining high ground is reserved for spruce or silver fir with beech according to soil conditions. Mattock planting is the method adopted. This method has already been described in the *Transactions*.[1]

In order that the members of the excursion party should get, in the time at their disposal, a comprehensive idea of the silvicultural conditions of the catchment area around the lake and a clear understanding of the general scheme of operations, certain sections were visited during a circular tour round the reservoir.

The party, on arrival, was met at Pont Cynon by Alderman Charles Rutherford, chairman of the Liverpool Water Committee; Colonel Davidson, water engineer; Lieut.-Colonel J. Forester Addie, agent; Mr Carsley, forester; Viscount Lewisham; General Sandbach (Bryngwyn); and Colonel Sandbach (Llanwryst).

The first area inspected was Bridge Covert, 3½ acres, planted in 1889 with Douglas fir and larch. The latter species has almost entirely disappeared in the thinnings, leaving a nearly pure crop of Douglas fir, with an average content of 9¼ cubic feet.

The Tyuchaf area, 375 acres, on the north side of the lake, planted 1913-14, 1917, 1918, 1920, and section 1 of Lechwedd, 130 acres, planted 1913-14, with the various coniferous species,

[1] See vol. xxvi. p. 38.

on the system already described, along with an admixture of beech, were next visited. The growth is excellent, and even silver firs, 6 years planted, are 5 feet high.

At Altforgan farm, at the head of the lake, a halt was made, where the party were kindly entertained to luncheon by the Liverpool Corporation, who were represented by Alderman Rutherford. After lunch Mr Rutherford extended a cordial welcome to the Society, and expressed the pleasure it afforded him to do so on behalf of the Liverpool Corporation. He thought those who undertook tree-planting were, necessarily, optimists and considered not only themselves but posterity as well. Mr Rutherford paid a compliment to the Scottish nation in this respect. The Scottish people took great interest in tree-planting because education, which for so long had been an important thing in the life of the Scottish people, had led them on to all kinds of scientific knowledge and research, and it had enabled them to be in the forefront in the matter of tree-growing, in which they were looking after the interests of posterity.

Mr Buchanan, in reply, proposed the Corporation of Liverpool. He said the Society were greatly indebted to the Corporation and to the Water Committee for their kind invitation. They had been much interested in all they had seen. The planting of so many trees would be of great benefit to the water supply.

Colonel Davidson and Colonel Addie briefly replied. Colonel Addie said he thought the Corporation had taken a wise step in safeguarding the water supply in the way they were doing, and probably they were setting an example to the whole of England in national afforestation. The Corporation had put into operation both forestry and sheep farming, and he thought he would be able to present figures to the chairman this year that would satisfy him from the financial point of view. He was glad the Society had been able to visit Lake Vyrnwy to see for themselves the biggest national effort in the way of forestry, sheep farming, and water supply, in which all the men employed were discharged soldiers.

The return journey was made by the south of the lake, and several interesting coniferous plantations were seen. At the top end of the lake felling operations were being carried out. The wood was planted in 1870 with larch, Norway spruce, Douglas fir, and Scots pine. At the present time, the crop

consists chiefly of larch poles 50 feet in height, and containing on an average 10 cubic feet per pole.

A nursery of 3½ acres, well stocked with healthy seedlings and transplants, was visited. The nursery management reflects great credit on those in charge. The estate sawmill, driven by electric power obtained from compensation water returned to the river, was also seen. After a newly formed plantation of 255 acres and a second nursery in the Marchnant valley were visited, the return journey was made to Shrewsbury.

On Thursday, the 24th, a journey of 32 miles was made to see the Kerry woods, which lie chiefly on the Brynllywarch estate on the borders of Radnor, Montgomery and Salop. The Kerry Hill is a long ridge which runs in a E.N.E. and W.S.W. direction at an elevation of 1490-1570 feet. The rainfall of the district is high, being estimated at about 50 inches on the higher land and southern slopes. Snowfall is irregular, and frosts are not severe. Shelter from wind on the northern slopes is good, but the southern slopes are more exposed, and the shelter on the top of the hill is small. The soil in both its chemical and physical properties is well suited for tree-growth. The whole of the woodland area was recently purchased by Mr Higginbottom, who resold certain portions to various firms of timber merchants, and the woods are in process of being felled. On arrival at Kerry village the party were met by Mr Anderson and Mr Maskery, representing Mr Higginbottom, and were conducted over the woods by them. The first wood visited was the New Pool wood containing Douglas fir 34 years old and 90 feet high, and larch 55 years old and 80 feet high. The wood is now being felled. Bettws Hill wood, situated at an elevation of 1350 feet above sea-level, contains about 2000 cubic feet of timber, quarter-girth measurement, per acre. This wood is also being felled. This wood was planted 34 years ago with spruce and Scots pine on what was originally rough grazing land. The wood had never been thinned, but the Scots pine had been mostly suppressed and killed out by the spruce.

After a halt for lunch at the Anchor Inn, which stands at an altitude of 1540 feet, some of the party visited the Cefn Golog wood, aged 44 years, and stretching from an altitude of 1000 feet to 1545 feet. Spruce, larch, and Scots pine were the three species planted. Spruce is doing well all over, larch is good

except where exposed to wind at the higher elevations, while Scots pine has been a general failure.

A block of Corsican pine, on a steep well-sheltered western slope in Fronderw wood, was seen from a distance. The volume of the dominant crop, as measured 8 or 9 years ago when the trees were 40 years old, was a little over 4000 cubic feet per acre, quarter-girth measurement.

Douglas fir does well, wherever shelter is afforded, on the north side of Kerry Hill.

The other section of the party which separated after lunch, returned by bus and were conducted by Captain Sydney J. Gammell over the prisoners of war camp, of which he had charge during part of the war. The camp consists of round huts, built by the prisoners themselves, of wattle and daub with grass roofs. The camp accommodated 150 German prisoners of war while employed in felling and cutting up timber.

Mr Willans of Dalforgan afterwards showed the party round his well-kept garden and grounds, which have been recently remodelled and improved by the introduction of ornamental shrubs and trees. A number of specimen trees planted 60-70 years ago were seen, including fine examples of Douglas fir, Norway spruce, *Wellingtonia*, Californian redwood, variegated sycamores, Nootka cypress, and *Sorbus intermedia*.

At Shrewsbury in the evening a conference was held, at which an interesting discussion took place as to the best means of protecting woodlands from fire.

It is to be regretted that the Kerry woods are being exploited with such little regard to the future. Many of the younger woods are still in a flourishing and healthy condition, and putting on sufficient increment to justify their retention until they have reached maturity. It is understood that there is no immediate scheme for the re-afforestation of this superb timber-producing area. Unless adequate measures are taken to replace these woods, which are being so ruthlessly cut for the market, the loss will be a national one. These woods owe their origin to the foresight and skill of one planter, who is happily still actively engaged in adding to the timber supply of the country on his beautiful estate in Northumberland. Mr C. J. Leyland of Haggerston Castle has long been known to foresters as one of the most enthusiastic and successful planting lairds of his day, and he justly deserves every credit for the splendid reserve

of timber which was, owing to his initiative and energy, available for the country at a very critical time of need.

When Mr Leyland first knew Kerry Hill there were practically no woods of any consequence, except near the keeper's cottage. His father planted a few shelter-belts of Scots pine, but these were unsuccessful owing, it was thought, to the wrong type of tree being used. The plants were of mid-European origin, and generally these give less satisfactory results than our own native or more northern types.

Mr C. J. Leyland began planting in 1875. The grazing at that time was of poor quality and the hill was unfenced, so the neighbouring farmers were allowed to turn on a certain number of sheep which grazed in common. There was originally a special Kerry Hill sheep, which through inbreeding was deteriorating, till Mr Leyland crossed his flock with Oxford Downs and these bred back to the Kerry Hill stock and saved the situation, but in 1879 the excessively wet season killed off scores of sheep. Farming in the succeeding few years reached a low ebb. Thousands of acres of grazing lands became derelict. Kerry Hill was practically worked out, so Mr Leyland decided to plant. The plantations were mixed but eventually spruce predominated. The larch in places was badly diseased and, as already indicated, the Scots pine did badly from the start, due partly, perhaps, to the source of origin of the seed.

Home nurseries were started at the end of the seventies, but one large brake of Scots pine were so damaged by black game that they were never planted out. There was a crop of good larch from seed which was collected in the spring, which Mr Leyland considers the proper time to collect larch seed. All the seedlings did well and escaped disease. Mr Leyland in all cases attaches great importance to pedigree, and seed was not collected from coarse and easily climbed trees, as such seed produces similar results. Planting was continued by Mr Leyland until he left the district in 1890. The fine specimen of *Abies grandis* which was seen by the party on the drive at Laighton Hall, is credited with being the largest in Great Britain. It grew 4½ feet a year in its early stages, and was planted by Mr Leyland about 1875.

The Kerry woods afford many valuable lessons to foresters and to the whole nation. Here is a practical demonstration that he who sows may reap, or at any rate see others reap, and

this fact should be kept in mind by those who are inclined to lay undue stress on the deferred returns from afforestation. No doubt the succeeding generations will derive most benefit from afforestation operations carried out now, but by scientific and systematic management returns can be got from forests within a more limited space of time than is generally supposed. Two of the men at present engaged in felling trees at Kerry were employed at the planting of those same trees. And similar cases are not lacking in other parts of the country, where within the memory of individuals a forest crop has been planted, grown, and reaped.

Friday, the 25th, was the concluding day of the excursion. A journey by bus of 29 miles was made via Chirk and Whittington to Llangollen. The interval before lunch was spent in visiting some of the places of interest in the neighbourhood.

After lunch, Mr Buchanan expressed the thanks of the Society to Mr Young, Divisional Forest Officer, for his valuable help throughout the excursion. Thereafter Mr Young was, on behalf of the excursion party, presented by Mrs Strathern with a piece of plate, suitably engraved, as a memento of the occasion. Mr Young in his reply said he had done no more than his duty as a member of the Society.

Four lady members were present throughout the excursion, and Mr George D. Forbes, who proposed the health of the ladies, remarked that this was the first occasion on which ladies had accompanied the annual tour, and referred to the presence on the previous day (at Kerry, where she is engaged in statistical work) of Miss Sutherland, B.Sc., the first lady to take the degree in forestry.

In the afternoon the party proceeded by bus to Berwyn station, where they were met by Captain Best of Plas Vivod. During a walk through Glen Berwyn some very fine spruce and larch about 45 years old were seen. After a visit to the saw-mill, which is driven by electric power, the party divided. Those who stayed behind were shown the admirably arranged and equipped farm buildings, where some valuable short-horn and Jersey cattle were seen. The other section of the party were conducted to the higher ground by Mr Young and Mr Alfred Price, supervising officer in charge of the operations, now nearing completion, of the Timber Supply Department. In the dingle under the Wilderness, at an elevation of about

1000 feet, spruce had a content of 12-15 cubic feet per tree at about 50 years old, compared with larch and Scots pine which had produced only 8-9 cubic feet. In the middle Wilderness wood, at an elevation of 1200 feet, the poles averaged 7-7½ cubic feet, while in the Wilderness at 1500 feet they averaged 2-3 cubic feet at 40-45 years. The timber is extracted by means of slides and cable tramways to the Glyndyfrdwy railway station. After a detour through the heart of the plantations a return was made by an easy descent to Llangollen, where the motors were rejoined for the return journey to Shrewsbury.

The excursion was the first one made to Wales by the Society, and it was in every way a great success. The well-arranged programme enabled the members to see silvicultural operations being carried out in all stages of forest growth.

16. Observations on the Planting of the Quicker Growing Conifers.

By Sir Hugh Shaw Stewart, Bart.

The huge increase in the cost of plants and of labour impels attention to the question of "spacing," for the avoidance of unnecessary waste of plants and of labour in planting and in unremunerative thinning operations. Such a consideration may be regarded as the negative side of the problem; but there is also the positive side, viz., to ascertain the best "spacing" for various species of conifers in order to obtain the best silvicultural results at the earliest economic period.

During the past fifteen years I have carefully watched the effects of close planting on Japanese larch and Douglas in Wiltshire (at Fonthill Abbey) on very favourable greensand soil, and of Japanese larch — for we have not sufficient depth of soil for much Douglas — at Ardgowan, Renfrewshire, on quite suitable ground.

The conclusion I have arrived at is that even the closest planting, at 3 feet, does not prevent, and only partially restrains, branch-growth, and that, if clean boles are required, hand pruning close to the stem must be resorted to.[1] To prove the

[1] As regards Douglas fir, I am supported in this statement by the head forester at Longleat, Mr A. Cameron.

inadequacy of natural cleaning, I will cite two instances:—(*a*) In the Bankfoot plantation at Ardgowan (planted 1898) Japanese larches were mixed with other conifers at 3 to 4 feet. The ordinary conifers were smothered years ago, but their skeletons remain.[1] That they had been of no real use in restraining side growth I can testify, having personally undertaken last winter the clean pruning of the Japs. *The lowest branches opposite the dead trees required quite as much work in removal as did the branches above the level of the dead tree tops.* (*b*) In the Swallow Brae plantation at Ardgowan (planted 1905) Japanese larches had been similarly mixed with other conifers at 3 to 4 feet. Here I took personal pains in successive years to shorten the branch-growth of the Japs in order to permit the other conifers to survive and grow. Actually the latter did grow to a height of 10 to 20 feet before being totally suppressed (as all of them except a few Corsicans are now). But here also, if clean boles are required, it will be necessary to prune the Japanese stems down to within a foot of the ground. For all the "cleaning" the other conifers effected, they might just as well not have been there at all. Indeed, they would have been better away, because the partial pruning which every one of the Japs received (to give the other conifers a chance) could more easily have been carried out in their absence.

There is a further consideration, viz. that of *root-room*. In a plantation of Japs mixed with other conifers, and in an adjoining plantation of Douglas similarly mixed, on the summit of the Beacon Hill at Fonthill, the strength of the surface roots of both Japs and Douglas is particularly noticeable for a space of several feet round each tree. The Japs and Douglas in these two plantations (planted 1902) have easily outgrown all the other conifers, with the exception of a few Weymouth pines among the Douglas, and where any ordinary conifers still survive, they appear to interfere with the strong root demand of both Japs and Douglas; and this without any benefit to themselves, for they are generally semi-suppressed, where not entirely dead, and will not pay for their own thinning out. Most of the dominant trees, both Japanese and Douglas, stand at a greater distance apart than 7 feet and are getting too much

[1] These have since been removed and burned. This plantation might have been thinned or clear felled for pit-wood, etc., several years ago, but was allowed to remain just as it had grown, for experimental purposes.

head-room accordingly, but this has encouraged individual timber increment, as the following measurements show:— Most of the Japs measure in girth at breast-height more than 20 inches; some, near the outside, give 31, 32, 35, and 36 inches. One Jap growing near the outside measured 40 inches in girth, and the head forester, Mr Garrett, computed the height to be 40 feet. The Douglas and one or two Weymouth pines in the adjoining plantation gave similar measurements. At Ardgowan, in the 15-year-old (Swallow Brae) plantation, the girths of the Japanese vary from 16 to 30 inches. I have not found many trees to measure less than 16 inches. In the older (22 years planted) plantation above Bankfoot, the Japs do not measure so well, but that may be accounted for by the fact that when the young plants arrived (as a gift) to be planted out they had lost their tops on the journey and so began badly. The trees nearest the outside, where they obtain the most light, give the best girth measurements, viz. 20 to 27½ inches. (Incidentally, this little plantation shows the fallacy of the idea, imported from the Continent and disseminated in some lecture rooms at home, to the effect that Japanese larch fail in height-growth after 16 years. A tree recently felled here showed a height-measurement of 45 feet, and the annual growth for the last five years showed an average of 22 inches.)

But what kind of problem awaits us where we have planted Douglas or Japs *pure* at too close intervals? There can be no value in the thinnings at an early age. On the other hand, if all are left to grow together those that fail to be dominant but just remain alive will be poor, skimpy poles, of little value, as I have tried to show, in checking the branch-growth, while they interfere with the root-room of their neighbours. In this connection, it may be asked whether we are not too prone to imagine that under "natural" forest conditions the spacing problem solves itself in the best interests of the health of the trees and their subsequent timber value? Such a belief may be corrected by the following quotation from Bulletin 24 (part 1, page 57), issued in 1905 by the U.S. Department of Agriculture, Division of Forestry, under the direction of the well-known Mr Gifford Pinchot. Writing of the natural American forest, he says:—"So great is the pressure when dense groups of young trees are evenly matched in size and rate of growth that it is not very unusual to find the progress

of the young forest in its early stages almost stopped, and the trees uniformly sickly and under-sized, on account of the crowding." Does it not seem a foolish proceeding to go to the labour and expense of reproducing by artificial means, over a whole area, an unfortunate state of things which is found to be inevitable in certain parts of the natural forest where young trees happen to be of an even size?

Sitka Spruce.

I have not had for so long a period a first-hand experience of Sitka, but have every reason to expect that what applies to Douglas and Japanese larch will, to some extent, apply to this no less quick growing tree. Where we have young Sitka growing pure at 3 to 4 feet, there is certainly a definite restriction of branch-growth, but it looks as if the time were not far distant when the same problem will arise, viz.:—What is to be done with trees growing with equal vigour when they begin to interfere with each other's root-room, and before there can be sufficient value in the thinnings to pay for their removal?

Is not the only remedy for too close (pure) planting of all the quicker growing conifers to use the bill-hook without loss of time, and that pretty freely? And should we cut over what the German foresters call the "wolves," *i.e.* the taller and more developed plants, leaving the more evenly grown, or should we act on the principle of leaving the strongest and cutting over the less developed?

In conclusion, recent observation informs us that individual trees, at any rate of the Japanese and Douglas species, on favourable soils can acquire marketable value after being planted 15 to 18 years. To obtain the greatest possible amount of cubic feet of such timber over a given area within that period, I advocate the following scale of planting distances:—

For Sitka spruce	(pure) . . .	$5\frac{1}{2}$ feet.
,, Japanese larch	,, . . .	6 ,,
,, Douglas fir	,, . . .	7 ,,

I admit that this will involve more than usual care in "beating up," and that a certain amount of branch shortening will be necessary in the earlier years until a canopy is formed, but the expense for these operations will not approach the cost

of the initial planting of much greater quantities of young plants to the acre. In any case, it seems clear that what may be reasonably close for ordinary conifers is unreasonably, and even disastrously, close for the quicker growing kinds.

P.S.—It may be convenient to append the table of plants required per acre (square planting).

3	feet apart	4840.	6½	feet apart	1031.
3½	,,	3556.	7	,,	889.
4	,,	2722.	7½	,,	774.
4½	,,	2151.	8	,,	680.
5	,,	1742.	8½	,,	603.
5½	,,	1440.	9	,,	537.
6	,,	1210.			

17. A New Disease of the Douglas Fir in Scotland.

(*With Plates.*)

By Malcolm Wilson, D.Sc. (Lond.), F.R.S.E., F.L.S., Lecturer in Mycology in the University of Edinburgh.

More than ten years ago my attention was directed by Dr A. W. Borthwick to specimens of the Douglas fir in which the leading shoot had been killed for a distance of 6-12 inches behind the apex. The trees were from 6-10 years old, and he suggested that the damage was not due, as was generally supposed, to frost. A few years later other similar specimens were received, and in these the fructifications of a species of *Phoma* were present on the dead shoots. Observations were then interrupted by the war, but during the last eighteen months numerous specimens have been obtained, many of them through the headquarters of the Forestry Commission in Scotland, and examination has shown that the disease is undoubtedly caused by a species of *Phomopsis*, a sub-genus of the large genus *Phoma*.

Specimens of the Douglas fir attacked by the disease have been received from several localities in Perthshire, from near Forres, and from Argyllshire, Dumfries and Inverness, and it may be concluded that the disease is widely spread in Scotland. The disease has been observed in trees up to about 10 years old, both in nursery stock and in plantations.

Two types of attack may be distinguished. In the first, the leading shoot (or occasionally a side shoot) is killed back for a variable distance, usually about 9 inches (Photos 1 and 2,

Plate IV.). In the second, the young tree is attacked a short distance above the ground-level, the outer tissues are killed either on one side only or completely round the stem, and ultimately the whole tree is killed (Plate V.). In both cases a very characteristic feature of the disease is the sudden decrease in diameter in passing from the healthy to the diseased portion of the stem, and this is very marked in the second method of attack described above, where the stem immediately above the diseased portion is abnormally increased in thickness. Numerous resin blisters are developed on the stem both above and below the point of attack (Photos 1 and 3), and after these have burst the whitish patches of dried resin are very obvious.

Some time after the stem is attacked, minute black fungus fructifications appear in large numbers on the dead portion, and in some cases on the dead leaves (Photo 2). These are at first covered, but are later on exposed by the splitting of the bark and finally project slightly above the surface. They contain very minute spores which in damp weather exude from the fructifications in mucilaginous filaments (Plate V., Fig. 4, *a*), or masses of whitish translucent appearance (Fig. 4, *b*, *c*).

It was at first believed that the disease is caused by the fungus *Phoma abietina*, first described by Hartig in Germany in 1889[1] as a parasite of the silver fir, on which it produces effects closely similar to those described above. This fungus has been stated by Böhm[2] to be the cause of a serious disease of the Douglas fir in Germany. It has also been recorded from France on the silver fir[3] and on a considerable number of different conifers in Denmark[4]. A careful examination of the Scottish specimens, however, shows that the fungus present differs from *Phoma abietina*, Hartig, in the shape and size of the spores and in the occurrence of a second kind of spore which has not been discovered in the fungus present on the silver fir. It also differs from *Phoma pithya*, Sacc., a species which has been confused with *Phoma abietina* but which is distinguished from the latter by the absence of definite sporophores. It is therefore proposed to give the name *Phomopsis Pseudotsugae* to

[1] Hartig, *Lehrbuch d. Baumkrankheiten*, 1889, p. 124.

[2] Böhm, *Zeitschr. f. Forst- u. Jagd-wesen*, 1896, p. 154.

[3] Prillieux et Delacroix, *Sur deux Parasites du Sapin pectiné*, etc. Bull. de la soc. mycologique de France, Tom. VI., 1890, p. 174-178.

[4] Lind, *Danish Fungi*, Copenhagen, 1913, p. 421.

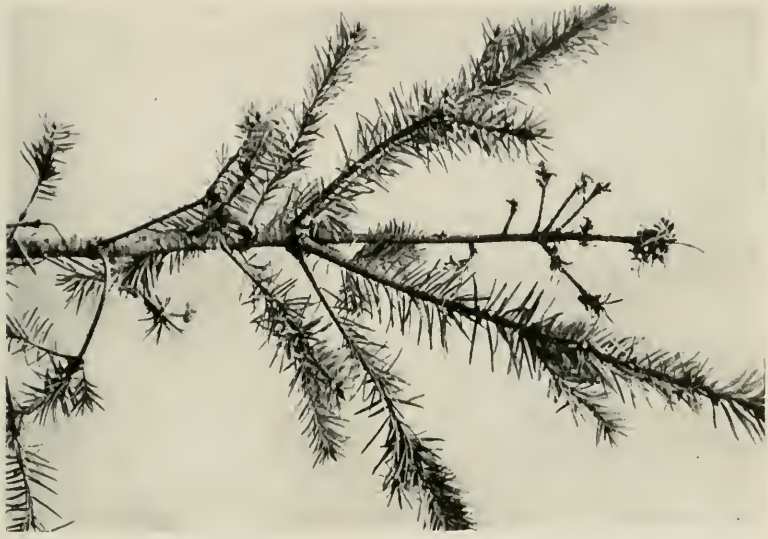

PHOTO 1.

PHOTO 2.

[*To face p.* 146.

PHOTO 3.

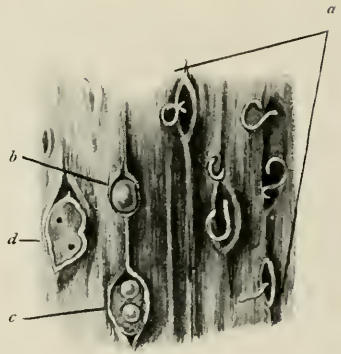

FIG. 4

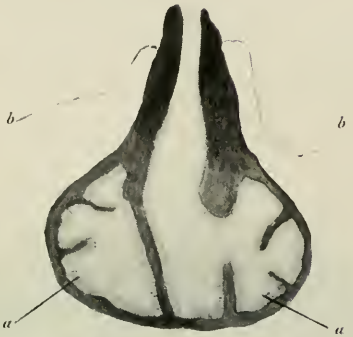

FIG. 5.

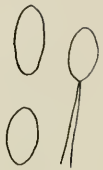

FIG. 6.

FIG. 7.

PLATE V.

the fungus found on the Douglas fir in Scotland. The description of the fungus is as follows[1]:—

Phomopsis Pseudotsugae, n.sp.

Pycnidia lens-shaped to conical, depressed and with a broader base, ·3-1 mm. broad, ·2-·5 mm. high, at first covered with the bark or leaf epidermis, later breaking through (in the case of the bark by an elongated slit) and projecting slightly, solitary or in groups of two, scattered, dull black and slightly roughened; texture everywhere several cells thick, more or less hyaline and tinged with green below, thicker and black above, opening with a definite ostiole; internal cavity partially divided up into several chambers by partitions greenish in colour and springing from the inner wall; spores hyaline, of two kinds—A-spores, elliptical-fusoid, obtuse at both ends, 5·5-8·5 × 2·5-4μ, without oil drops but with a minute granule towards one or both ends, with subulate sporophores about 13μ long; B-spores, rod-like generally curved, obtuse at each end without oil drops, 5-6 × 1·5μ with subulate sporophores 12-14 × 1-2μ.

The spores are shown in Figs. 6 (A-spores) and 7 (B-spores). The pycnidia containing A-spores are generally rather larger, often in groups of two, and have been found on the older parts of the host-plant, never on the leaves; only A-spores have been found on plants attacked near ground-level. Pycnidia containing B-spores are usually rather smaller, more decidedly conical, solitary, and have been found on both surfaces of the leaves, usually on the upper surface, and on the younger parts of the one-year old stems. Both kinds of spores emerge from the pycnidia in similar ways (Fig. 4). The sporophores usually remain inside the pycnidium attached to the walls and forming a distinct zone (Fig. 5, *a*). They are quite distinct in the young pycnidium, and can be seen attached to the spores (Figs. 6 and 7), but in the older pycnidia they appear to become mucilaginous and partially disintegrate.

A plantation of Douglas fir in Perthshire, about 6-8 years old, was examined in April of this year, and it was estimated that half of the trees had been killed by the disease. The dead trees were removed and burnt and the spaces were filled up by planting fresh trees. In September about 20 % of the trees were showing signs of attack, and these included some of those planted in the previous April.

[1] See also *Trans. Bot. Soc.*, Edin., vol. xxviii., pt. 1 (1920).

The method and time of attack are not yet fully known. Ripe spores capable of germination have been collected in April and October, and it is probable that infection takes place during the summer. In all probability the species is a wound parasite; this must certainly be the case where the main stem of plants, 4-8 years old, is directly attacked not much above ground-level, although it is possible that young uninjured shoots may become infected.

The narrowing of the stem in the infected portion is the result of the death of the cambium and consequent stoppage of secondary thickening. Probably some considerable time elapses between infection and death of the cambium. In the case of a tree 6-8 years old infected near the base, secondary thickening of the infected portion probably ceases about a year after infection when the leaves begin to turn yellow; death probably takes place during the following winter. In a tree in which the leading shoot is infected near the apex, growth continues during the following summer and death of the shoot takes place in the winter. Fructifications of the fungus are often found all over the dead trees, and it is evident that the fungus can live on as a saprophyte after the death of the tree.

From the above observations it may be concluded that *Phomopsis Pseudotsugae* is widespread in Scotland, and is probably increasing in abundance; it is doing very considerable damage to young plantations of the Douglas fir. At the present stage of our knowledge of the fungus little can be said as to prevention, but it is especially necessary to emphasise one point in this connection. Owing to the long period which elapses between infection and the first obvious signs of the disease, it is possible that nursery stock which is apparently healthy, although really diseased, may be planted out, and in this way the disease may be widely distributed. The following general precautions should be taken:—

(1) Young plantations should be carefully examined for trees showing the early signs of the disease, and these should be removed and burnt. All trees killed by the disease should be at once removed and burnt.

(2) Plantations, and especially nurseries, should not be established in areas known to be infected.

In conclusion, I wish to thank Miss L. Snelling for the drawing shown in Fig. 4, and Mr R. M. Adam for Photos 1, 2 and 3.

Explanation of Plates IV. and V.

All the photographs and figures refer to *Phomopsis Pseudotsugae*, n.sp., on *Pseudotsuga Douglasii*.

Photo 1. Four-year-old tree with leading shoot killed. About ½ nat. size.

Photo 2. Apical portion of dead leading shoot of a four-year-old tree; the pycnidia can be seen on the stem and leaves. About ¾ nat. size.

Photo 3. Four-year-old tree attacked near ground-level; resin blisters on bark above and below constricted portion. About ¾ nat. size.

Fig. 4. Portion of a young shoot showing pycnidia; *a*, A-spores in the form of mucilaginous tendrils emerging from several pycnidia; *b*, a single pycnidium from which a rounded mass of A-spores has just emerged; *c*, a group of two pycnidia from each of which a rounded mass of A-spores has emerged; *d*, a group of two empty pycnidia, each showing an ostiole (as a rounded black dot). × about 16 times.

Fig. 5. A pycnidium containing B-spores seen in longitudinal section (the spores are not shown); *a*, the layer of sporophores; *b*, outermost layer of bark. × about 35 times.

Fig. 6. A-spores, some still attached to sporophores. × 720.

Fig. 7. B-spores, some still attached to sporophores. × 720.

18. Notes on Jack Pines and Sitka Spruce.

(*With Plates.*)

By James Kay, B.Sc.F.

The three Jack pines are regionally distributed throughout Canada and the United States, and cover large areas of poor soils. This is due principally to their extreme hardiness, early and large seed production, and ability to seed up burned-over lands to the exclusion of more valuable species.

The three forms are :—

1. Eastern Jack Pine (*Pinus banksiana*), extending from Nova Scotia to the Rocky Mountains, and the valley of the M'Kenzie river, where it meets the lodgepole pine.

2. Lodgepole Pine (*Pinus contorta* var. *murrayana*), extending over the whole of British Columbia, from the Yukon territory in the north and the eastern slopes of the Rocky Mountains, and east to the Cypress Hills in Alberta.

3. Scrub Pine (*Pinus contorta*), found on the coast (Pacific), from the coast of Alaska to Northern California. It is usually found in sphagnum-covered bogs and the margins of deep wet swamps, but spreads inland and ascends the

mountains, where its appearance and habit gradually change into the lodgepole form. This so-called species, however, is generally looked on as but a form of lodgepole, and is of little value except for firewood.

Eastern Jack pine (*Pinus banksiana*) is one of the small commercial pines. As a timber tree it is not so valuable as white pine or red pine, but owing to its wide distribution, it is being more extensively lumbered each year, owing to the disappearance of the more valuable pines through logging, and the remoteness of existing stands from transportation facilities.

Botanical Characteristics.—The leaves are in two's, $\frac{3}{4}$ to $1\frac{1}{4}$ inch long, stout, oblique, diverted, and in remote clusters, falling in the third or fourth year. The fruit is $1\frac{1}{2}$ to 2 inches long, lateral, oblong-conical, oblique at the base, sessile, usually strongly incurved like a beak; scales thin and stiff and armed with a small rudimentary prickle; cones opening irregularly, and persisting 10 to 15 years, often becoming woody. The tree fruits early, from the fifth to tenth year, in close stands 10 to 15 years later, but the best seed production is between 35 to 75 years. It has been found that a normal tree 10 to 15 inches in diameter will produce annually 200 to 500 cones, each cone bearing 15 to 30 seeds. In dry years a few of the cones open on the tree, but it usually takes fire to open them. The germination percentage is from 60 to 70%, and the seeds are viable for many years. Growth is very slow during the first ten years, but after the root-system is established, the tree grows from 1 to 2 feet annually. This growth continues under favourable conditions till about the fiftieth year.

In dense forests the crown is narrow, open, and confined to the upper part of the tree. In open stands the stem is clad almost to the ground with long spreading branches, covered with cones their entire length, giving the tree a somewhat curious appearance. The bark is thin, scaly, dark brown, and the percentage of bark as compared to that of the total volume varies but little. The average of 100 trees was found to be 11%.

The tap-root is deep, with strong spreading laterals, rendering it wind-firm. The tree will grow on poor shallow soils, but reaches its best development on deep sandy plains where the roots can go deep and have room to spread. In such soils it attains a height of from 60 to 90 feet, with a diameter of from

JACK PINE, 45 YEARS, IN OPEN STAND, ON SANDY PLAIN.
PETAWANA EXPERIMENTAL STATION.

LODGEPOLE PINE, AFTER FIRE, WITH PURE STAND ON HILLS IN BACKGROUND.
ROCKY MOUNTAIN FOOTHILLS.

[*To face p.* 150.

FELLED SITKA SPRUCE, QUEEN CHARLOTTE ISLANDS,
Scaling upwards of 25,000 feet board measure.

12 to 20 inches; on wet soils bordering swamps the mature tree seldom reaches 60 feet.

M. L. Fernald, in his paper on "The Lithological Factors limiting the range of Jack pine and *Thuya occidentalis*," states that "Jack pine is confined exclusively to formations without lime." He terms it "calciphobious."

On the better classes of soil it associates with white pine, birch, and aspen, and with red pine on deep dry sands deficient in humus, and is normally found in dense stands after fire, varying from 5 to 100 acres in area. Later, when the crowns open up, balsam and spruce come in. The presence of birch in the stand is a sure indication of good quality Jack pine.

The tree is intolerant at all ages, therefore seedling growth is rarely found under mature stands. It is said that the facility of reproduction after fires, and the inability of reproduction under mature stands means that Jack pine forests can in nature only be secured by fire. Owing to the density of young stands there is no ground vegetation, but later when the stand thins out a strong growth of small plants comes up. The most common are *Vaccinum*, *Cornus canadensis*, *Lycopodium*, *Pteris aquilina*, *Clintonia borealis*, *Lonicera canadensis*, *Gaultheria procumbens*, *Smilacina procumbens*, *Aralia nudicaulis*, etc.

The stem has a moderate taper. Trees with much taper indicate poor soil conditions; full-boled trees are found only in the deep, coarse, sandy plains which are its natural habitat. Jack pine reaches its best development in the Great Lakes region. The wood is light, soft, close-grained; heartwood, light brown; sapwood, thick and nearly white. It is used mainly for railway sleepers, posts, fuel, Kraft pulp, and sawn into lumber for rough construction work.

Lodgepole pine.—In the early days lodgepole pine received its common name from the Indians, who used the tall, slender young trees for their tepee poles. This species, though similar to the eastern Jack pine, differs from it in some particulars. The leaves are longer, being from 2 to 3 inches, and thicker on the branches; the bark is darker and thinner. Seedling growth is rapid, and leaders have been measured from 2 to 3 feet in length, but the average total growth is comparatively slow. After fires in mature stands natural reproduction is too dense, and as many as 300,000 one-year-old seedlings have been found on one acre. In the Deer Lodge National Forest, U.S., stands

following fires have been found which, at the age of 8 years, had a maximum density of 175,000 live seedlings per acre, averaging 2 feet high.

In dense stands lodgepole forms a tall, slim, slightly tapering stem, with a narrow conical crown. The size is variable, but the average height runs from 60 to 80 feet, with diameter ranging from 7 to 15 inches. Individual trees with a height of 100 feet and a diameter of 30 inches have been measured.

Unlike the eastern Jack pine, lodgepole forests are largely confined to the mountains, reaching an altitude in British Columbia of from 5000 to 6000 feet, and in the United States of 11,000 feet. It is very hardy, and can stand extremes of temperature from 100 degrees F. to 50 degrees below zero. In the lodgepole region the growing season is short, and frost and snow may occur at any time. The habitat is comparatively dry, but it requires a precipitation of over 20 inches to produce well-developed stands. Too much soil moisture is hurtful, and good drainage is essential. It is not exacting in its soil requirements, but it grows well on rocky and sandy soils, although the best soil is a gravelly loam.

The U.S. Forest Service say of lodgepole pine—"In relation to its light requirements lodgepole exhibits three striking characteristics—intolerance of any considerable degree of overhead shade, ability to survive for long periods in a badly crowded or suppressed condition in pure, even-aged stands, and ability to recover and make increased growth after being released from suppression." In dense stands of lodgepole there are usually large numbers of suppressed trees from 1 to 5 inches in diameter, of the same age as the dominant trees, and these will persist to the end of the rotation.

The U.S. Forest Service have studied the effects of thinning in lodgepole stands. One tree studied was released from suppression when 94 years old. In 16 years its diameter had increased from 1·44 inches to 5·06 inches, and its height from 15 to 25 feet. The rate of growth increased from 1 inch in diameter in 67 years to 1 inch in 4 years, and from 1 foot in height in 7 years to 1 foot in 1·6 years. The rate of growth increased 4680%. One stand, 160 years old, contained approximately 3500 trees per acre, no more than 4 inches in diameter; for commercial purposes they were practically of no value.

Lodgepole within its own range forms large pure stands. At

its lower limit it is found with Douglas fir, which occupies the drier sites. At its upper limit Engelman's spruce and Alpine fir come in on the moister sites. The wood of lodgepole is similar to that of *Pinus banksiana*, and is used for the same purposes.

These pines though comparatively small will become increasingly valuable as the larger species, yielding better grades of lumber, are cut out. They cover immense areas of inhospitable soil, and for local use they will always be useful as cordwood and small-sized lumber. Their extreme hardiness and thriftiness on poor soils, the large amount of seed produced, and their ability to take possession after fires, will ensure a continuous supply of timber if properly safeguarded.[1]

Sitka spruce (*Picea sitchensis*) is also known as Menzies spruce, Alaska spruce, tideland spruce, giant spruce, and silver spruce. It is the largest and most valuable of all the spruces. It extends from Alaska southwards along the coast of British Columbia, Vancouver Island, Queen Charlotte Islands, to California, but rarely occurs more than 50 miles inland.

It is usually found on flat, moist, sandy, often swampy, soils along the coast, extending inland along well-watered valley bottoms, and rarely reaches 1000 feet above sea-level. The timber on elevations above this limit is comparatively small, yielding a coarse grade of lumber. In the northern part of its range it goes up to 3000 feet, but is then reduced to a mere shrub. The largest and cleanest timber is found below 500 feet.

The leaves are dark bluish-green in colour, flattened, sharp pointed, $\frac{1}{2}$ to $1\frac{1}{2}$ inch long, standing out stiffly from all sides of the branches, and often nearly at right angles to them; the stomata are mostly on the upper surface. The fruit is cylindrical-oval, short stalked, and hanging from the tips of the branchlets. The cones vary in size from 2 to 4 inches long, and the scales are thin and papery. Sitka spruce is a prolific seeder, with heavy seed years at intervals of 2 to 3 years. The cones ripen in autumn and early winter, and are deciduous. The seed is shed before they fall off the tree. The seed has a high germination percentage and persistent vitality. Seeds germinate best in a moist to wet soil, and the seedlings are frost-tender the first few years only.

[1] A table showing the average growth of lodgepole pine will be found in Bulletin 154, U.S. Department of Agriculture.

The crown is dense and pyramidal, covering about two-thirds of the stem. The lower branches persist for many years, hence dense stands are essential to the production of clean lumber. Sitka spruce is very tolerant in early youth, later it is less so than its associates, the giant arbor-vitae and western hemlock.

The root-system is shallow and spreading, the bole tapers moderately, and has an enlarged base, in dense stands it is clear for 50 to 80 feet. Sitka spruce is one of the largest trees on the Pacific Coast, reaching a height of from 100 to 130 feet, and diameter of 3 to 6 feet. Trees are found 150 to 200 feet high with a diameter of 8 to 12 feet. Owing to the ameliorating influence of the Japan current, and the warm, humid winds blowing from it, the climate here is mild and uniform. In the northern part of the tree's range the temperature falls to 30 degrees below zero. Precipitation is heavy, 60 to 70 inches, in the middle part of its range, and varies from 20 inches in California to over 100 inches in Alaska.

Sitka spruce forms large pure forests, especially in the northern part of its range. On the coast, where it reaches its largest size, its chief associates are Douglas fir, western hemlock, and western red cedar. It can be procured in very large sizes, the tall straight boles furnishing lumber of the best quality and of the largest dimensions, usually clean and free from defects. The wood varies in colour from white to light brown; it is soft, light, and easily worked, but tough and very strong for its weight. It is even-grained and long-fibred, flexible and resonant and non-resinous. It does not split or warp. Being odourless and tasteless, strong and light, it is specially suited for cooperage and boxes for packing food-stuffs.

For structural work where great strength is required Sitka spruce is not so suitable as Douglas fir, but it is used for framing, shelving and sub-flooring, piling and cribbing; it provides excellent material for car stock; it is also used for parts of light implements and vehicles. When sawn tangentially (slash grain) Sitka spruce has an attractive grain, and is admirably suited for panelling, office fittings and furniture; it is very suitable for interior finish, takes glue and paint well, is easy to nail and does not split.

It is unsurpassed for aeroplane construction, this being due to the long straight grain and fibre, the toughness and lightness, and the large clean sizes obtainable. In ten months, British

Columbia forests produced enough spruce lumber to construct 20,000 aeroplanes. When cut into thin boards, its resonant quality makes it useful for piano sounding-boards, organ-pipes, and stringed instruments, and it is a very valuable pulpwood. Spruce wood is considered to produce the best grades of paper, and as the demand greatly exceeds the supply, the wood of this tree will always find a ready market. The growth of Sitka spruce is rapid and persistent after the first few years. Under proper silvicultural management it will prove itself a valuable tree for forest planting, provided it is set out in suitable soils and in situations with ample soil and atmospheric moisture.

19. The Landes of Gascony.[1]

(*With Plates.*)

By M. E. Lapeyrere.

The value of the Landes as a timber-producing area has been well shown in the recent war. Many British and American visitors showed a very keen interest in the resin industry, and it is hoped that the short account given below may help these and others to appreciate the importance which these forest areas possess. A short historical account of the development is of special interest in countries in which the forest services are still young, and in Great Britain, at all events, many problems will inevitably arise that strongly resemble those that did arise in the history of the forests of the Landes area. The questions dealing with the influences of ownership in management and the degree of State interference that is justified are of special value. The nature of the forest service established in Great Britain has been well presented to French readers by M. Humbault in a recent issue of *Revue des Eaux et Forêts*. Special prominence is given to the emphasis laid on the preservation of private ownership and the promotion of private enterprise. The real justification set down for the establishment of a forest service and a national forest area in Great Britain, is the provision of a reserve of timber that may be available in any set of conditions which may arise and create a situation similar to that from

[1] Translated, in an abbreviated form, from the original French by James Fraser, B.Sc.

which the country was recently delivered. The influence of war supplies in the development of the Landes area presents a certain amount of similarity to the influence exercised in Great Britain.

The forest tree of first importance in the Landes area is the maritime pine. It is an indigenous tree, and the cultivation of the tree as a timber-producing one has been practised for many centuries. The value as a sand-fixing agent and as a resin-producing tree was recognised at a time when systematic silviculture was unknown. The work performed by Bremontier and Chambrelent in the extension of the maritime pine forest is well known to most readers of forestry literature, and on account of the wide publicity of the work done by those two workers, it is not surprising that the work of earlier improvers should have received little attention. There are, however, many records of the early existence of extensive forest areas in the Landes, and of the definite afforestation of tracts of waste land with a view to the fixation of the blown sand. The literature dealing with the subject is scattered, and many of the references are to be found only in the municipal records of the larger towns of the country. The early maps of the district, the evidence to be obtained from the study of peat in the country, and the national records of laws established for the purpose of protecting national interests are also valuable sources of information. The persistence of certain words in the language of the people gives still further evidence of the antiquity of the early recognition of the value of resin in the district.

One reference to the very ancient practice of resin extraction may be cited. In one of the epistles of Ausone, use is made of the word "toedas." The word is explained by Baurein to mean that part of an old pine that has been exploited for the resin, and which burns like a torch when a chip of it is set alight. The word is still used. Later records of direct afforestation in the Landes are preserved in the archives of Bayonne. As they refer to a period much earlier than that at which the work of improvement is commonly supposed to have begun, some attention may be given to them.

One of the earliest refers to the planting of *Psamma arenaria* as a preparatory measure in the sand fixation of the common land belonging to Boucau Neuf. Several inhabitants of the town are given the task of planting forty arpents of land. The

MARITIME PINE, AGE 19 YEARS, PRUNED, ABOUT 350 TO ACRE.
Tapping has commenced on several of the trees.

MARITIME PINE, MIDDLE-AGED WOOD.

[*To face p.* 156.

MARITIME PINE WOODS TO SHOW APPEARANCE IN THE LATER STAGES OF THE ROTATION.

contract is drawn up by M. Harran, notary of Bayonne, and is dated 21st December 1622.

Later records deal with the purchase and sowing of seed, and give details of the expense incurred in sowing areas with the object of fixing the sand; the dates of these outlays are all placed in the first half of the seventeenth century. Towards the close of the century it was found necessary to lay down very strict laws with regard to the practice of certain individuals of the Anglet district and of the captains of vessels moored in the river of Bayonne. These individuals had cut the forest on the banks of the river to such an extent that the sands which were formerly fixed by the trees were now driven by the winds into the river, where they formed banks. Strict directions are given for the promulgation of the law, and lists of fines for offences against the law. It is clear, then, that even at this date the value of the tree was known to the people.

A map published in 1590 by Jean Waghemer and added to the *Flambeau de la mer* of the same author shows that the land from Soulac southwards was covered by forest. A later map, published in 1640, indicates at a position marked Port de Coutes forests where resin is obtained. Maps of later date in the same century show woods along the river bank from Soulac to Pauillac. It is not easy to give an accurate estimate of the area that was really under forest crop at the time when the extensive operations of Chambrelent were begun, but an examination of the *Carte de l'Etat-major* would suggest that the areas of bare land shown in the districts of Bordeaux and Lesparre are not so extensive as those shown in the work published by Chambrelent in 1887.

The peat records and discoveries made in the course of working the lignites of Laluque confirm the written records. Pine stems have been found, with hazel and oak, in the Laluque workings. In 1834, the discovery of pine stems marked with incisions similar to those made in resin exploitation was reported at Castets. These were covered with a layer of peat 70 cm. (2 ft. 3 ins.) thick. There are also records of pine stems found in the same area in 1896; these stems were covered by about one metre (3 ft. 3 ins.) of peat.

Further historical records may be considered in connection with the nature of the early products obtained from the pine. The earliest products were "terebenthine," "barras ou galipot,"

"poix," "resine," "brai." Oil of turpentine and tar were not yet considered important.

At a later date, about 1664, when tar had become a valuable product for naval purposes, it was considered necessary to forbid the adulteration of tar with such material as turpentine. Certain of the terms used to describe the products of resin exploitation may be explained, as they may not be generally known. The "gemme" is the product which exudes from the tree on the "care" or "face" made by the resiner on the stem of the tree. As the season advances, a portion of the "gemme" solidifies on the "care"; this solid portion is the "barras" or "galipot," while the more fluid portion passes into the receptacle which, up to the year 1860, consisted of a hole in the ground called the "crot." The hole was placed at the foot of the tree, and had the shape of a peaked cap. The "gemme" and the "galipot" were poured into an open boiler, and heated with a naked fire until they were fused; they were then poured over a filter of straw or heather; the larger part of the impurities was removed in this manner, and the filtered product was then allowed to settle. The water contained in the filtrate was removed by decantation; the residue was termed "terebenthine" or "pâte de terebenthine." If the filtered gemme was heated again, the oil of turpentine gradually evaporated, and also a certain amount of water. The whole product was then gently heated, and when a sample solidified on a cold surface, the contents of the pot were run into moulds hollowed in the sand. The solidified mass was termed "resine." If in the last process the heating was continued to such a point that no water or oil of turpentine remained in the residue, it was termed "brai sec." The straw or heather used as a filter was burned in an oven of ovoid form; this oven was in communication with the exterior through a narrow canal. Fire was kindled at the top of the pile, and by means of the upper cover of the oven, the rate of progress of the burning was controlled. The product of the process was obtained at the base of the furnace, and was led away through the narrow channel. The product was named "poix." The production of charcoal was carried out as at the present day. "L'encens" consisted of transparent drops of resin which were found a little below the soil around the old roots of large trees; this material was sometimes burned in the poorer churches. The same name was sometimes applied to the resin obtained

from *Pinus Pinea*, which gives a slightly aromatic odour when burned.

The importance of tar as a naval supply caused a development of the manufacture of tar. Colbert obtained the services of several Swedes for the purpose of teaching the people of the Landes how tar should be made. The material used for this product consisted partly of roots of old trees; these were cut into short faggots. The most resinous parts of the stem, however, formed the chief source of tar. The manufacture was carried out in a structure known as a "four à gaze"; this consisted of a wide conical receptacle lined with clay or brick work and connected with the exterior by means of a narrow channel. The prepared billets of wood were arranged within the receptacle; they were stacked in three or four tiers so as to give a semi-ovoidal form of stack. They were then covered over with turf so as to give a compact cover. Fire was kindled at the top and controlled so as to extend gradually to the base. Tar was led away through the prepared channel, and when all the tar that could be obtained had passed out to the vessel ready for its reception, the temperature of the contents was allowed to rise and the wood was then carbonised. The tar canal was not allowed to remain open throughout the process of tar extraction, but was opened only three or four times per day, to allow of the withdrawal of the tar accumulated at the base of the oven. In such an oven, if the content of wood amounted to 70 steres (about 2500 cubic feet), a yield of 9000 litres (about 2000 gallons) of tar could be realised, and the charcoal residue amounted to about 405 steres (14,300 cubic feet). When the tar was manufactured from the superficial parts of the trunk which were covered with barras the product was called "brai gras." The same term was used to describe a product obtained by mixing "brai sec" and tar. From the year 1382 onwards, references to these various products are common.

One more interesting to British readers may be given. A record of the export of resine and terebenthine to Great Britain by one Pierre Dousseau, in the period 1532-1550, shows the importance to which the industry had attained. The orders issued by the Government of the period in connection with the manufacture of tar are specially instructive. Two of these orders may be briefly summarised. The first appeared in the year 1672, a short time after the Swedes referred to above had

left the country. Rules with reference to the lighting of fires in pine areas, either for purpose of clearing of land or for the manufacture of charcoal, insisted on the responsibility of all parties for any fire damage that might be caused by carelessness or neglect. Definite directions are given for the selection of the material that might be used for the manufacture of tar for naval purposes, and it is forbidden to make a product which consists of a mixture of tar derived from roots and heartwood and tar derived from wood normally used for production of "brai gras." The season of preparation is restricted, and in order to encourage the industry it is forbidden to impose any tax or duty on the product that would be liable to restrict the profit of the makers. At a later date the order was repeated in a stricter form and additional clauses were added. This later order appeared in 1725. It would appear that the adulteration of the products had become rather a serious affair, and that the makers not only required instruction as to methods of manufacture but also some moral guidance in commercial integrity. It is shown that stones, sand, wood, and such material, although it increases the weight of the barrel, is of no value for the purpose of improving the value of the resin. Goats, sheep, or other domestic animals found in young pine crops are declared to be liable to confiscation. In order that the products of resin manufacture might at all times be traced to the maker in cases of infringement of the laws, it is laid down that all material manufactured must bear the mark of the maker. Inspectors were appointed to enforce the laws. Further intervention of the State in the management of pine areas is recorded at a slightly later date. It had been found that certain landowners, anxious to realise quickly the value of the standing timber on their land, had developed the practice of selling trees for purpose of charcoal manufacture. These trees, it was argued, should have been left standing so long as they were capable of giving a yield of resin products. Removal from the ground caused a direct loss to the workers and to the nation. In 1725, therefore, a royal order was published which expressly forbade the cutting of such trees without the necessary authority. The export of resin products to England, Ireland, and Holland had for a time a rather discouraging effect on the industry. It was represented to the Government that owing to the export of resin products to these countries the price had unduly increased, and that in

the national interest the export should be forbidden. The policy was indeed one not worthy of a Government that had the real State interests at heart. The increased price of resin products was less than would be expected, and the value of these when estimated in terms of the common necessities of life show that it had not risen in price to the same extent as such commodities as rye and millet. The immediate result of the order was to discourage the cultivation of pine. Two orders appear to have been published with this object of discouraging export; one was issued in 1714 and the other in 1776. The orders were repeated later. Towards the latter date the creation of an extensive fleet had given rise to an increased demand for resin products, and the increased demand had caused a slight rise in the prices. The price, however, does not seem to have been of a figure that would greatly encourage the extension of pine areas if revenue from invested capital was considered.

In 1783, oil of turpentine made its first appearance on the market at Dax. Up to this time it was not regarded as a distinct commercial product that could be marketed.

The study of the earlier laws of land tenure and land acquisition throws a considerable amount of light on many of the present-day problems in this pine area. It frequently happened that, owing to the poverty of the owner and to his mismanagement of his property, he found himself unable to pay the taxes that were due from the land he held. A common method of escaping from such an awkward position was to abandon the land to the community, which then became liable for the payment of the taxes. Such presents of land were not regarded very favourably by the people. The point is important when considering the increased value of the same land at a later date. An inhabitant of the community had the right of appropriating for his own use a portion of the common land; the appropriation could be effected without payment for the capital value of the land, but certain rights were always retained by the community. The person who acquired the land then became liable for payment of all taxes. In some cases a certain payment for the land might be made, but as it was possible to acquire without payment, allowance should be made for the fact when comparing values paid at this time and at later dates when it was no longer possible to acquire common land without payment for the capital value. The existence of

many of the extensive estates now held by private individuals in this area is due to the exercise of the rights of individuals to appropriate common property. The difficulties at the present day of dealing effectively with fires are due to same cause. A man wishing to acquire land usually wished to possess some part from which he could reasonably expect some revenue, and so it frequently happened that the only lands left for the community were those that were incapable of yielding a revenue. The land appropriated would not necessarily be in one continuous stretch. A redeeming feature of the laws governing the right of private appropriation was the condition enforced with regard to the retention of forest crops on areas capable of growing trees. The administration of communal property was, as a rule, entrusted to jurats named by the community and appointed for a definite time. There were usually two of these; the position does not seem to be one that was greatly desired, but once appointed, it appears to have been difficult to dispose of the appointment. The jurats were assisted in the work by a syndic, who was also appointed by the community. The care of the municipal interests was no enviable position. Those appointed made the necessary contracts for the leasing of communal property; they were also responsible for the protection of the property against private individuals of the community and against individuals of neighbouring districts. It sometimes happened that certain persons within the community worked the common property in such a manner that they derived the benefits while the community as a whole suffered. The support given to the syndic in his unpopular office was frequently not of a nature that strengthened his position. More enlightened communities drew up and enforced rules of management for their forest property. They provided for the necessary work of cleaning of young woods by means of a contribution of labour exacted from men of the parish. Timber required for public purposes was felled by direction of the syndic. Felling of timber by individuals was forbidden under pain of a fine. Litter raking in young pine woods was forbidden, and the sale of resin rights was controlled for the benefit of the community. Fire protection was provided for in case of resin-melting plants, and farmers were forced to perform the necessary clearance of litter and undergrowth around roads. If these failed to perform the work required it was performed at their expense.

The process of improvement in general conditions in the Landes area was a gradual one. The work of early times has been noted, and the early recognition of the value of pine forest has been established. The necessity for the draining of the surface was evident. L'Abbé Baurein, writing in 1784, records the improvement caused by the draining of the marshes around the Seigneurie de Lesparre. The contract for the work was drawn up in 1628; the work was undertaken by several Flemish families. A second contract for further work of the same kind was drawn up in 1633. The result of such undertakings was not only to bring a large area under cultivation, but also to free the district from the continual evil effects of large extents of stagnant water. Other examples of similar work performed are recorded by the same writer. The work of improving the land was undertaken by many different persons, and when Chambrelent, in 1849, acquired the area of Pierroton there were already within a very narrow circle numerous examples of the improvement brought about by earlier workers. The work of improvement was checked for a period by the revolution, but later it was continued by many wealthy companies. As forest crops were less likely to give high returns than field crops at the time, the immediate effect was rather to conserve any existing forest than to create fresh forest areas. The constant risk of loosing the forest crop through fire, and the necessary exclusion of stock from young pine woods, acted as a deterrent to speculation in forest crops.

The opening of the Bordeaux-Bayonne railway in 1855 necessitated the construction of certain works of improvement, which was reflected in the price of timber and resin in the district, but the revenue obtained was still unsatisfactory from a financial standpoint. An unforeseen event, and one quite beyond the control of the country, caused a wave of prosperity in the land that has never been surpassed. The American war of 1860 prevented the export from that country of the resin products, and a rise of prices in Europe resulted in consequence. Although the prices fell on conclusion of the war, they still remained at a figure that gave a revenue worthy of consideration, and as a result planting became common and the future of the district as a forest area was assured. The general development of the area was continued by the building of roads.

At the present time, areas of maritime pine are most commonly regenerated by natural regeneration. In cases where the pine is grown on land that did not previously bear a crop of pine, the crop can be established by sowing or by planting. When the young crop has reached an age of about eight or ten years the young branches are pruned over the whole length of stem that is covered with furrowed bark. The blanks in the crop are filled up, and the crop is thinned so that the trees are spaced out at intervals of about 3·50 metres (11½ feet). At fifteen years, in good localities, the tapping of the trees begins. Only those trees are tapped which will be removed in a later thinning when about 220 trees are left on the hectare (2½ acres). A third thinning made later still will bring down the number to 150-180 trees per hectare. The trees which are to be removed in thinnings will be tapped to death before they are removed, but the 150-180 trees that are destined to form the main crop will not be tapped until they have reached such a size that a man who surrounds the stem with his arm can no longer see the tips of his fingers. The exact time at which the thinnings are made, and the year in which the tapping is commenced, will depend on the locality.

The first "care" or "face" is made on the south-east side of the tree, on which the roughest bark is generally found. In February, the bark of this side of the tree is cut so as to expose a smooth surface; the wood is not cut. The prepared surface is about 10-15 cm. (4-6 inches) broad at the base of the tree, and the height of the prepared surface is about 60-70 cm. (23-27 inches). From the end of February onwards, the resiner removes from this surface a slice of about 9 cm. (3½ inches) broad, and of about 1 cm. (⅖-inch) thickness. During the first year, the scar made in this manner reaches to a height of 65 cm. (26 inches). In the second year, it is extended by 75 cm. (29 inches); in the three years that follow, it is increased by 80 cm. (31 inches) each year. Six to seven collections of resinous material are made in the course of one season. In order to carry out the necessary operations of extending the scar from which the resin flows, use was formerly made of a "crabe." This consisted of a pine stem on which were nailed several triangular blocks of wood. The resiner was able to reach the position on the stem on which he wished to extend the scar. This apparatus is now rendered unnecessary by the use of a long-handled tool with a cutting edge at right angles to the

PLATE X.

OLD MARITIME PINE IN LATE STAGE OF THE ROTATION

GENERAL VIEW OF SWAMP ROUND SMALL RIVER CLOSE TO CASTETS.

[*To face p.* 164.

British Army Dumps of material obtained from Maritime Pine Forest

handle. The second scar is placed to the right of the first at a distance of about one-third of the circumference; the third scar separates the first two exactly. If the tapping is continued, the fourth cut is made between the first and the second; the fifth, between the first and the third; the sixth, between the second and the third; the seventh, between the first and the fourth; and the eighth, between the second and the fourth.

The resin which runs from the scar is caught in an earthenware pot. The pot is supported above by a sheet of zinc which guides the flow of resin into it, and the pot is kept in position against the zinc sheet by means of a nail driven into the trunk of the tree. The zinc plate itself is driven into the trunk of the tree. The resiner collects the resin from the pot every fortnight. The collecting vessel is usually square in form, and it is emptied into a reservoir made of wood and sunk in the soil. From this reservoir it is emptied into barrels of 340 litres (75 gallons); sometimes a barrel of 225 litres (50 gallons) is used; the barrels are filled through square holes left in the sides, and covered with wooden lids. In these barrels the resin reaches the factories, where it is manufactured into marketable products.

The resin is deposited at the factory in large stone reservoirs; it is left in these until the process of purification is to be begun. It is then heated in large open copper vessels over naked fires. The temperature is allowed to rise to about 212°–266° F., when the heavy impurities fall to the bottom, and the lighter are removed by means of a long-handled sieve-like tool. The material so obtained is allowed to cool, and is the terebenthine. This product is poured into a copper retort heated by means of a steam jacket. Steam is passed into the heated substance, and the vapours coming off are condensed in a condenser. When the heated mass no longer gives off turpentine the residue is drawn off from the retort. It is filtered over a special filter, and the impurities are retained on this. The material collected from the first three collections in the forest gives the colophony of commerce; the colour varies from pale amber yellow to honey yellow. The products of the later collections from the forest are darker in colour; they may be divided into "brais clairs" and "brais noirs." The refuse obtained in the two processes of cleaning which have been mentioned is used to obtain the products known as "poix." Further products may be obtained by treatment of the products that have been

mentioned. In this account only an outline of the manufacture is given.

The greatest scourge in the forests of maritime pine and the strongest argument against the investment of capital in such a type of undertaking is fire. These fires are almost invariably caused either through carelessness, or from fires lit for the purpose of clearing the land for the sake of the pasture that may be obtained on the cleared ground. If the fire is discovered at an early stage it is easily extinguished, but frequently it happens that, owing to the scattered nature of the population, it has got such a hold that practically the only method of fighting that can be adopted is that of counter-firing. The defence is itself one that is exceedingly dangerous, and it should only be employed when it can be effectively controlled. As a rule March is found to be the most dangerous month, as at that time the surface growth is dry and the young shoots have not yet been formed; they offer, therefore, an ideal surface for the rapid spread of fire. Extensive fires are common every year, but that of the year 1735 stands out prominently. It is supposed to have been started by a beggar on account of the treatment given him by a native of St Michel. The area destroyed was 50,000 hectares (125,000 acres). Old men and children, unable to escape from the rapidly advancing fire, perished; houses were destroyed over the whole surface, and sheep were suffocated in dense flocks. The process of forest destruction continues in this manner each year. Methods of dealing with fire have been advocated, such as clearing of broad fire lines. The proposal is not a recent one, and it has been seen that in communal property provision was made for the removal of surface vegetation with a view to forming a kind of fire line. In the north it is not possible to utilise the surface vegetation for litter, and in addition the area in question renders the removal impossible. The formation of fire lines involves a loss of productive ground to the owner of the land through which the line passes. In a district where small proprietors are common, considerable hardship might result. The proposal to avoid such loss by growing broad-leaved species on the fire line is impracticable. The species which would succeed are few, and the success as a fire line is doubtful. Where it has been found that active steps for prevention of spreading are possible, proprietors have united in protective associations and contribute

to the expense involved a sum that is proportional to the extent of their properties. In such cases the surface of the soil on either side of the roads is cleared of all growth so that an absolutely bare stretch with a breadth of 15-20 metres (50-65 ft.) is obtained. It appears that some measure of protection might be obtained by enforcing the existing article of the civil code, which forbids planting of trees within 2 metres ($6\frac{1}{2}$ ft.) of the boundary running between two adjacent properties.

Meanwhile the fires continue to occur.

20. The Six-Toothed Bark Borer of the Spruce, *Pityogenes* (*Tomicus*) *chalcographus*, L., and how to recognise it.

(*With Plates.*)

By R. Stewart MacDougall,
Honorary Consulting Entomologist to the Society.

In the autumn of 1919 my colleagues, Mr J. L. Pike and Mr D. C. Fergusson, gave me specimens of this beetle which they had collected in the summer at Dunkeld. Dr J. W. Munro records, in Bulletin No. 2[1] of the Forestry Commission, that *P. chalcographus* was observed at Dunkeld breeding in fallen spruce stems and on suppressed trees of 6 years old and upwards. In the first week of May of this year near Birnam I found the beetle at work on a small spruce in association with *Pityogenes bidentatus*, and at work on the top of a felled 20-year-old Scots pine in which *Tomicus acuminatus* was also tunnelling. With Mr D. C. Fergusson and Mr F. O. Bain we got on the same Scots pine, on a branch 3 inches in diameter, *P. chalcographus* and *Pissodes pini* at work. Later in May several of my students brought me *chalcographus* in all stages under the bark of spruce from the same area.

P. chalcographus, believed to be scarce in Britain and very local in its distribution, may turn out—as with other forest insects considered rare until better knowledge and skilled intensive search proved them at least fairly common—to be not so rare. The beetle is very small and needs close examination for its determination, but with keen eyes and a pocket-lens and

[1] This Bulletin, *Survey of Forest Insect Conditions in the British Isles*, 1919, gives an excellent and timely account of our chief forest insects, and should be in the hands of all foresters.—R. S. M.

the help given by the characteristic pattern of its brood-galleries, any interested forester will be able to run it down.

The Adult Beetle (Fig. 1):—*Pityogenes chalcographus* measures from over $\frac{1}{14}$ to $\frac{1}{12}$ inch. The colour of a beetle which has come out into the open is black-brown to reddish-brown. A very helpful point in determination of the beetle is that generally it shows two shades of colour, the thorax and the front part of the wing-covers being dark (black-brown) and the hinder part of the body pale copper-coloured or light chestnut. The antennae—which are very small and end in a round club (visible with a lens)—and the legs are yellow-brown.

The head can scarcely be seen from the upper surface. The thorax (it is really only the front part of the thorax which is visible from above) is longer than broad; if one looks down on it, with a lens, the front part is seen to be rough or granular and the hind part to be very finely punctured; a longitudinal central line and a spot on each side (not easy to see) are quite smooth. The wing-covers show rows of fine punctures which die away behind the middle, especially leaving the sides smooth. At the hind end the wing-covers show a steep slope with a furrow on each side of the suture; on each side of the slope there are three spines or teeth; these teeth are directed slightly inwards and are best seen if the beetle be examined from the side. The teeth are equidistant and almost of the same size. For experimental or other reasons the sexes may be distinguished on careful examination, thus:—

Male.	Female.
The three teeth at the hind end prominent.	The three teeth at hind end weaker and set slightly further back.
Furrows at hind end deeper.	Furrows shallower.
The forehead entire and arched or convex.	The forehead with a deep impression or groove.

The larvae are typical Scolytid larvae, legless, with brown horny head and jaws, and wrinkled white-yellow bodies; the body is slightly thicker at the front joints. The pupae are yellow-white, and are found in beds at the end of the larval galleries.

Nature of the brood-galleries.—P. chalcographus is polygamous. The male enters the bark from the outside and excavates a pairing-chamber. Typically this pairing-chamber is in the middle of the bast layers. Here mating takes place with four to eight females, each of which proceeds to gnaw a gallery for

PLATE XII.

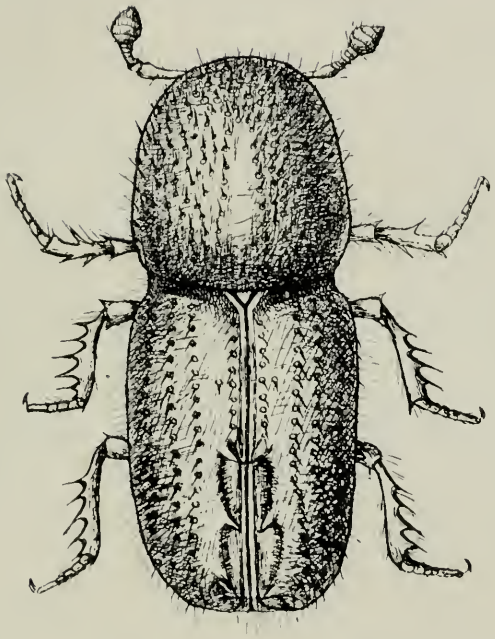

FIG. 1. PITYOGENES CHALCOGRAPHUS, L.
Greatly magnified. Drawn from nature.

[*To face p.* 168.

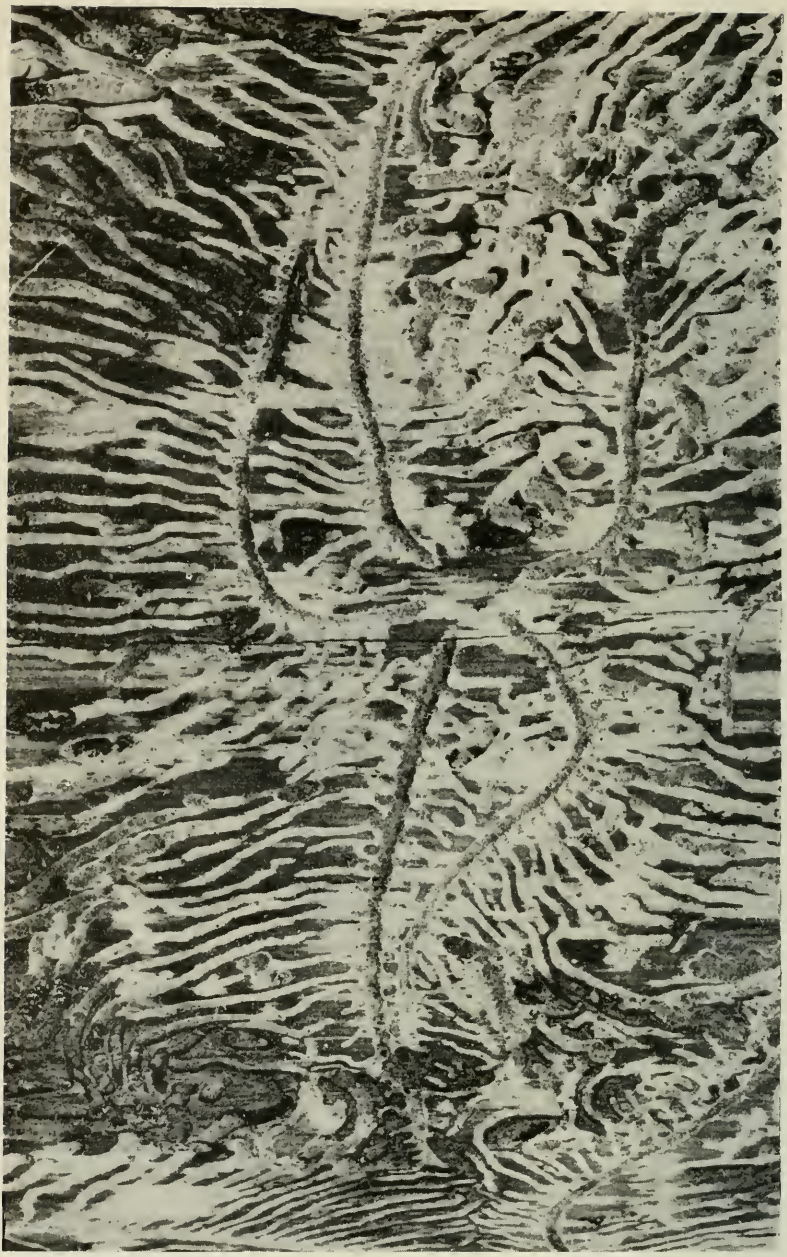

FIG. 2. STAR-LIKE PATTERN OF THE MOTHER-GALLERIES OF P. CHALCOGRAPHUS. The larval galleries are seen running out on both sides of the mother-galleries. An enlarged photograph from nature.

herself; along each side of the gallery eggs are laid in little notches. The mother-galleries, four to eight in number, according to the actual number of females, run out in star-like fashion, and it may be in a somewhat winding way, from the pairing-chamber. These mother-tunnels show on the inside of the bast, and mark the sapwood, but not deeply. Typically, the position of the pairing-chamber buried in the bast renders the pairing-chamber invisible from the inside of the bast, and thus the mother-galleries, examined on the inside of the bark, appear to be separate from one another, not meeting at a point. The diameter of a mother-gallery is about $\frac{1}{25}$ of an inch. The larval tunnels that run or wind from each mother-gallery are comparatively short, and are close to one another. Pupation takes place at the end of the larval gallery, the pupal beds being in the bark.

P. chalcographus goes especially on thin-barked parts; on unhealthy spruce on the higher-up thin-barked parts and branches, and on suppressed young plants, and on felled spruce.

While spruce (*Picea excelsa*) is the typical host-plant there are continental records on *Pinus sylvestris*, *Pinus cembra*, *Abies pectinata*, and *Larix europaea*.

Other Species that can be Confused with P. chalcographus.

Confusion sometimes arises between this species and the related *Pityogenes bidentatus*, the two-toothed pine beetle, a very abundant species which, though chiefly limited to pine, is also found on spruce.

The adults may be distinguished thus:—

P. bidentatus.	*P. chalcographus.*
Larger, $\frac{1}{12}$ to $\frac{1}{10}$ inch.	Smaller, $\frac{1}{14}$ to $\frac{1}{12}$ inch.
All one colour, black or dark brown.	Two-coloured, dark in front and pale behind.
The sides of the wing-covers with rows of punctures right to the apex.	Sides of wing-covers smooth towards the apex.
The hind end of the wing-covers of the male shows a broad circular impression with a large somewhat curved or hook-like tooth on each side.	The hind end of the wing-covers of the male shows a furrow on each side of the suture and three teeth.
The hind end of the female has a steep slope furrowed on each side of the suture, but there is no tooth.	Hind end as in male, but the three teeth are less prominent.

The male of *Pityogenes quadridens*, in addition to the large curved tooth of *P. bidentatus*, has an additional smaller tooth on the lower third of the apical declivity.

As regards the pattern of the brood-galleries *bidentatus* and *chalcographus* may be distinguished thus:—

P. bidentatus	*P. chalcographus*
Polygamous.	Polygamous.
Mother-galleries radiate from the pairing-chamber in a more or less star-like pattern.	Mother-galleries radiate from the pairing-chamber in a more or less star-like pattern.
Pairing-chamber visible on the outside of the wood and the inside of the bark, and the mother-galleries visibly meet in it.	Pairing-chamber generally hidden in the bark, and the mother-galleries seem to be quite separate from one another.
Mother and larval galleries cut into the outermost wood.	Mother and larval galleries mark but do not cut distinctly into the wood.
Larval galleries come away from each mother-gallery, not close together but at some distance apart from one another.	Larval galleries come away from each mother-gallery close to one another.

The foregoing differences have to be regarded as typical, but, of course, exceptions are met with.

There are two other bark-borers of spruce, one of them very rare in Britain and the other only doubtfully recorded. Careful search might reveal them, and they are worthy of mention here. They are *Pityopthorus micrographus*, Gyll., and *Polygraphus pubescens*, Bach (*polygraphus*, L.).

P. micrographus is smaller than *P. chalcographus;* it has an elongate appearance, and is brown in colour. On the front part of the thorax there are minute excrescences or tubercles arranged concentrically. The declivity at the hind end of the beetle shows a distinct furrow on each side of the suture; no teeth are present on the declivity in this species, but a good lens will bring out minute tubercles down the edges of the furrows; if the insect be viewed in profile, it will be seen that the suture and the side edges of the furrows are equal in height and slope downwards at the same angle. The beetle is polygamous and the mother-galleries, several in number, run out in stellate fashion from the pairing-chamber; there is a tendency for the mother-galleries to take a somewhat horizontal direction. Pairing-chamber, mother-galleries, and larval galleries cut markedly into the outermost wood.

The other beetle, *Polygraphus pubescens*, is larger than *P. chalcographus*, reaching $\frac{1}{10}$ inch in length. It comes nearer the pine and ash bark beetles than any of the beetles previously named here. Fowler describes it as very rare and gives Scarborough as the locality. It is a polygamous species found in the bark of spruce. A common name for it is the four-eyed spruce-bark beetle, this name being given because each of its two eyes is almost separated into two halves; this is an excellent recognition-character for the genus, but a very good hand-lens is required to see it. Another good character for our species is the rimey or frosted appearance of the wing-covers, due to a series of pale-coloured scales. The antennae are also characteristic but they require a microscope, and all through these notes I have aimed at characters which need only a pocket-lens at most.

P. pubescens is polygamous, and the brood-galleries are chiefly in the bark; the larval galleries run in different bast-layers, and therefore a complete picture of a brood-gallery system is not seen on the inner surface of a peeled-away piece of bark, but only isolated streaks and scratches of mother-galleries and larval galleries. This beetle, while chiefly a spruce-infesting form, has, on the Continent, been taken on other conifers.

Amidst the heavy fellings all over the country conditions are favourable for finding *P. chalcographus*, and perhaps *P. micrographus* and *P. poligraphus*. I am very willing to examine doubtful specimens, and would record, in the *Transactions* of the Society, any discoveries. It will have been noticed that all the species dealt with here are polygamous species, and the forester has therefore a guide, from the pattern of the workings, as to whether or no the species is the one being sought.

21. David Douglas, Botanist, at Hawaii.[1]

By Gerald W. G. Loder.

Mr W. F. Wilson has brought together under one cover accounts of David Douglas which have appeared at different times, particularly those relating to his visits to the Sandwich Islands.

A few years ago the Royal Horticultural Society published the diaries of Douglas between the years 1823 and 1827, together with a memoir and several appendices.[2] We do not think there is much fresh matter in Mr Wilson's pamphlet, but at the same time every scrap of information about Douglas is of interest, and the pamphlet is enriched by two portraits and several illustrations connected with Douglas's visits to Hawaii. These two publications probably contain all that we shall ever know about this famous man. One paper in Mr Wilson's pamphlet, which does not appear in the R.H.S. publication, re-opens the question of the circumstances attending his death. It is an account by Messrs Pickering and Brackenbridge, two members of the Wilkes Exploring Expedition, of a visit they paid to the scene of Douglas's death about $6\frac{1}{2}$ years afterwards.

After describing the pits and the situation, they go on to state that there were many circumstances leading to the suspicion that Douglas had been murdered by Ned (Edward Gurney) at whose house he had breakfasted before setting out on the fatal morning. Messrs Pickering and Brackenbridge do not say what these circumstances were, beyond that Ned was an escaped convict from Botany Bay, and that Douglas's servant who had parted from him that morning also perished—we are not told how. According to Messrs Pickering and Brackenbridge the post-mortem which Dr Judd and Dr Rooke made when the body reached the coast, was ordered in consequence of the suspicions against Ned, but that it revealed no wound which could not have been inflicted by a bull. It should be observed that the same suspicion seems at first to have arisen in the minds of the two missionaries, Joseph Goodrich and John Diell, who forwarded the original account of Douglas's death home, but subsequently

[1] David Douglas, botanist, at Hawaii, by W. F. Wilson, *The New Freedom Press*, Honolulu, 1919.

[2] See *Transactions*, Royal Scottish Arboricultural Society, vol. xxix., part 2, page 134, for review of this publication by F. R. S. Balfour.

they seemed to have been satisfied with Ned's description of what happened. This story is well known, and need not be repeated here; it is now generally accepted as in the main true. At the same time it must be remembered that they derived their information from Ned, and there will always be some doubt as to what actually happened, first, because Douglas had safely passed the pits in the path, of which Ned alleges he had warned him, and left his dog and bundle a short distance beyond them, and secondly, because it is hard to believe that he deliberately retraced his steps and fell into a pit, the covering of which must have been removed, if a bull had already fallen in. One possible explanation is that while two of the pits were in the path, a third (in which the bull had presumably fallen) was a short distance off the path, and that after he had passed he heard something in this pit and returned to ascertain the cause, and approaching too close accidentally fell in himself.

Another possible theory is that he returned in order to get water from a small pond near the third pit, and fell into the pit, still covered over, and that subsequently a bull also fell in, the concealment not having been completely removed by Douglas's fall. We should add that these speculations are not Mr Wilson's but our own.

No motive has been suggested for Ned desiring to kill Douglas, but in such a remote spot an unscrupulous scoundrel would require very little temptation, and it would not have been easy to distinguish between a wound inflicted before or after the body was thrown into the pit tenanted by an entrapped bull.

On the whole, however, the probability seems to be that Douglas did in some unfortunate manner fall into the pit already or subsequently occupied by a bull.

It is curious that although Douglas was buried in a grave in the churchyard of Kawaiahao at Honolulu, bricked over by order of the British Consul, its site could not be located some years after when a headstone was sent out. This was therefore fixed to the front wall of the church.

A pathetic interest attaches to the fact that the faithful Scotch terrier that watched Douglas's bundle while the fatal scene was being enacted, was sent home to Mr Bandinel, a clerk in the Foreign Office, and, we believe, eventually reached Douglas's family.

22. Estate Nurseries and Plantations Competition, 1920.

The Nurseries and Plantations Competition for 1920 was held in the Aberdeen Show district of the Highland and Agricultural Society, which includes the counties of Aberdeen, Banff, Kincardine, and the eastern part of Forfarshire.

As was to be expected the Competition on this occasion was a smaller one than that held in 1915. Many proprietors, owing to scarcity of labour and other reasons due to the war, were unable to keep up the high standard of care and attention which formerly obtained in their wood management. Planting operations on many estates had to be entirely suspended, and estate nurseries had to be abandoned to other uses than the growing of forest plants. Notwithstanding this handicap, the entries in the Plantations Competition were fairly representative of the district, with the exception of Class IV., and a high standard of excellence in the care and management of the plantations was observed.

The subjects entered are given below in the order of merit:—

NURSERIES.

CLASS I. (For nurseries under 2 acres in extent).

One entry.

Estate	*Owner*
Drum . .	A. F. Irvine

PLANTATIONS.

CLASS IV. (Conifers not exceeding 10 years of age).

Estate	*Owner*	*Species*
Countesswells	Sydney J. Gammell	Scots pine.
Drum . .	A. F. Irvine	Scots pine.

CLASS V. (Conifers not exceeding 20 years of age).

Estate	*Owner*	*Species*
Fyvie . .	Lord Leith	Japanese and European larch.
Drum . .	A. F. Irvine	Scots Pine.

CLASS VI. (Conifers 20 years to 40 years of age).

Estate	*Owner*	*Species*
Balmoral .	H.M. The King	Douglas fir, 35 years old.
Fyvie . .	Lord Leith	Spruce, 27 years old.
Countesswells	Sydney J. Gammell	Scots pine and larch, 29 years old.

As regards the one nursery in competition, it can be said that it is a model of all that an estate nursery should be. The owner confines himself to the rearing only of plants required for his forestry operations. Provision is made for a periodical fallow crop, and the nursery contains a full stock of healthy plants of all ages required.

In the Plantations section of the Competition, the subjects entered for competition in Class IV. were both plantations of Scots pine. This species has perhaps to contend with more enemies in the course of its life than any other of the conifers most commonly used for forest planting. The squirrel, to mention one enemy, has probably reduced the value of a very large proportion of the younger and middle-aged pine woods in the north-east of Scotland by as much as one-third, and this now makes it very difficult to assess the true value of the species as a timber crop in the locality. Woodland owners are now fully alive to this danger, and it was pleasing to note that squirrels appeared to be kept well down on all the estates visited, and no evidence of squirrel damage was apparent in any of the woods entered in the Competition.

With reference to the subjects in Class VI., special mention should be made of the good results obtained with Douglas fir at high altitudes. The 35-year-old Douglas fir plantation at Balmoral on poor sandy soil is situated at an elevation of about 1000 feet above sea-level. A measured plot shows a production of 3630 cubic feet (under bark) exclusive of thinnings, with an average height-growth of 61 feet. The plantation, even at this early age, carries a large proportion of trees suitable for railway sleepers and larger-sized scantlings.

The spruce wood at Fyvie, entered in the same class, is deserving of special notice, inasmuch as it provides an example of high production in spruce timber in a locality where Scots pine has been proved to yield rather poor results. The spruce in this case gives approximately a yield of 2700 cubic feet at 27 years of age with an average height-growth of 40 feet. Although not strictly comparable with the Douglas fir wood in the same class, owing to difference in age and environment, it is worthy of notice that the spruce in this case does not come far short of the Douglas fir in the actual annual volume of timber produced.

Full particulars of the plantations entered are given in the accompanying table.

PARTICULARS OF COMPETITION, 1920.

NAME OF ESTATE .	Drum.	Countesswells.	Fyvie.
Description . .	SCOTS PINE, 18 acres.	SCOTS PINE, 22 acres.	LARCH, 26 acres.
Class	IV.	IV.	V.
Soil	Gravelly.	Moorland gravel and "pan"; granitic.	Loam on Schist.
Elevation . . .	100-120 feet.	500-520 feet.	300-350 feet.
Rainfall . . .	30·5 inches.	26 inches.	36·4 inches.
Aspect . . .	Undulating.	S. and W. gentle slope.	North-west.
Shelter . . .	Plantation to west.	From east and in early stages from west.	Moderately sheltered.
Previous occupation of land	Timber.	Partly timber, partly heather.	Timber.
Rent of land adjoining	Arable, 20s. per acre.	Arable, 25s. per acre.	Arable, 20s. per acre.
Date of planting .	1911.	Spring, 1911.	1902.
Cost of planting:	Not known accurately.	Not known accurately.	...
(*a*) Fencing . .	,,	,,	£2 per acre.
(*b*) Draining . .	,,	,,	...
(*c*) Planting (including making up blanks) . .	,,	,,	£6 per acre.
(*d*) Cleaning . .	,,	,,	7s. per acre.
(*e*) Soil cultivation or other outlay .	,,	,,	...
Species planted . .	Chiefly Scots pine with a few larch.	Pure Scots pine with patch of pure larch at S.W. corner.	Japanese and European larch, 50 % of each in pure blocks.
Age of plants used .	2-year 1-year.	2-year 2-year.	2-year 1-year.
Method of planting and number of plants per acre .	Notching. 4840.	Notched. 4000-4500 per acre; made up in 1913; proportion of plants used, 10 %.	Notched. 3500 per acre.
Date of thinnings (if any)	No thinnings.	No thinnings.	No thinnings.
Damage by fungi, insects, birds, mammals . .	A few plants eaten by rabbits, larch damaged by hares.	Damage by weevils in spots. A little damage by rabbits, most damage by disbudding by Black game. Black game still damage leading shoots.	Some damage by rabbits and roe deer. *Peziza* to some extent on European larch. No disease on Japanese larch.
Damage from other causes . . .	About half an acre destroyed by fire, and replanted 1920.	No other damage.	No other damage.

PARTICULARS OF COMPETITION, 1920.

Drum.	Balmoral.	Fyvie.	Countesswells.
Scots Pine, 44 acres.	Douglas Fir, 7 acres.	Spruce, 20 acres.	Scots Pine chiefly.
V.	VI.	VI.	VI.
Loam on hard "pan."	Sandy gravel ; granitic.	Loam.	Rock and gravel ; granitic.
150-240 feet.	950-1000 feet.	200 feet.	300-350 feet.
30·5 inches.	36 inches.	36·4 inches.	26 inches.
North.	North-east.	East.	South and west
None.	Moderate.	Sheltered on east.	Sheltered from west.
Timber.	Scrub birch.	Partly timber, partly arable.	Thin crop of larch formerly.
Arable, 20s. per acre.	Pasture, 6s. per acre.	20s.	30s. to 35s.
Winter, 1904-05.	1885.	1893.	Spring, 1891.
Not known accurately.	Not known.	Not known accurately.	...
,,	...	...	...
,,	No drains.	...	...
,,	...	...	£3, 8s. per acre for planting only. Other costs not accurately known.
,,	...	...	
,,	...	...	...
Scots pine with 10 % larch, a few *Abies nobilis* alongside ride.	Douglas fir, 90 %. Larch, 5 %. Spruce, 5 %.	Spruce.	Stem mixture per acre : Larch, 1000. Scots Pine, 2000. Hardwoods, 500.
2-year 1-year.	4-year-old.	2-year 1-year.	2-year 2-year.
Notched. 4840 per acre.	Pitted. 1250 per acre.	Notched. 3500 per acre.	Notched. 3500 per acre, made up with 2-year 2-year Scots Pine only, 1897.
No thinnings.	...	No thinnings.	...
Slight damage by rabbits and hares.	Slight damage to larch by squirrels.	Some damage by roe deer.	Some damage by beetles, and later by rabbits.
...	A little damage by snow and wind.	...	...

23. Commercial Forestry in the Highlands.

By Alex. M'Pherson.

During recent years it can scarcely be said that timber has been grown as a financial venture, and indeed this question seldom crossed the mind of a planter who owned his estate, as more frequently his idea was to utilise, by planting, any unsightly land or what was useless for the plough, and (this paper refers chiefly to Highland conditions) to cover rough, rocky land in the vicinity of his mansion-house. These woods when they grew up made splendid game preserves, without which the pheasants could not be placed in cover; and, with the exception of the actual planting of the trees, which was purely the work of the forester, the gamekeeper frequently had the predominant voice in the management of the woods. On some estates the gamekeeper and the forester worked together on fairly amicable terms and with good results. Notwithstanding this fact, however, there were produced in Britain some very fine forests, which proved of untold value to the nation during the Great War.

The passing of the Death Duties Act hit Highland proprietors very hard, even to the extent of restricting planting operations, or the re-planting of those areas which by law of entail they were entitled to re-plant. I venture to say that this Act has done more harm to the Highlands than the framers of the Bill foresaw, as it resulted in the wholesale turning away of the people who found a living on those estates. These duties should, in my opinion, only be imposed on Highland proprietors at long intervals of years and at a much decreased rate.

I may therefore affirm that death duties, assisted by other forms of taxation on forest land, practically strangled Highland forestry, which is a national calamity because nowhere are there such fine facilities for planting as in the Highlands.

In practice it has been found that large blocks of timber give better financial returns than small woods or mere belts, such as it has been the usual custom to plant in times past. It is proportionately cheaper to fence the larger woods, and as larger woods give rise to better silvicultural conditions they yield larger volumes of cubic contents per unit area. It is also of the utmost importance to plant the right class of trees in the

soil and situation which best suit them, and also the trees which will afford the quickest financial returns. Near large industrial centres it is possible to obtain a monetary value for every part of the tree which is cut down. In England, where hardwood predominates, when a tree is felled the trunk is stripped of its branches and the whole is classed into cord-wood, faggots and timber. From each tree top 1½ scores of faggots and a half cord of firewood are taken on an average, equal in value to about 12s. If the trunk measures 50 cub. feet the working expenses will be 9s., and in the case of ash or oak the price obtained for the timber, if of good quality, will be 4s. per cub. foot or £10, 12s. for the tree, against an expenditure of 12s.

In the Highlands of Scotland there are no such facilities for disposing of all parts of the trees which have been cut down, and this together with the excessive taxation which I have already referred to militates against successful forestry, and has driven the population into exile—a population second to none, as has been again proved so recently as in the late war. Yet Highland landowners must plant timber if only for the upkeep of their farm buildings, fences, workmen's houses, etc., because the price of foreign timber for this class of work is absolutely prohibitive. In the early history of estates, when they were gifted by the Sovereign as an honour for work done in the nation's cause, they were regarded as a trust, to be worked for the best interests of the community. Times have, however, changed and so have the laws, and all for the worse so far as the Highlands are concerned.

After an experience of many years as a forester in the Highlands, I have come to the conclusion that the growing of pit-wood should be the staple form of forestry, matured timber being only grown where the situation is especially good and for the general purposes of the community. I think that the Highlands should be entirely devoted to pit-wood, matured timber to be left for the south and east where transport facilities are better.

The following are actual facts regarding pit-wood returns for Argyll.

Five years ago pit-wood at the age of 19 years realised, after allowing for cost of original planting, annual rates, rent and management at compound interest, a yearly return of

16s. 9d. per acre. This particular lot was grown 400 feet above sea-level on very rocky land and entirely exposed to the prevailing south-west winds.

Another lot of pit-wood in the same county was sold 3 years ago as a first thinning at the age of 27 years. The number of poles procured was 7540 and the price realised was £950. The work of felling and classifying into lots was done by contract, costing 6d. per pole, and the poles thus classified were sold lying on the ground. Had all the pit-wood been larch a much higher value would have resulted. This plantation, of which I have charge, is 37 acres in extent, and has an average of 500 standing trees per acre, with an average length of 30 feet and equal on an average to 4-inch pit-wood. This works out at 15,000 lin. feet per acre, and at 20s. per 100 lin. feet equals £150 per acre, or £5550 for the whole plantation at present prices.

In 1919 another lot was disposed of at the age of 23 years. The outlay in planting, rates and taxes, management, etc., was allowed for at compound interest, and an annual return of £3, 4s. 5d. per acre was obtained. The ground was approximately 400 feet above sea-level and exposed to the wind.

The foregoing has thoroughly convinced the writer that some parts of Argyll at least are more adapted for growing pit-wood than timber, because although magnificent larch, Scots pine and spruce can be grown, the difference in price between timber and pit-wood is very marked, viz. 8d. to 1s. for best larch; 7d. to 11d. for Scots pine and spruce; while the price for pit-wood at 24 years works out at 1s. 3½d. per cub. foot. Pit-wood on a 19 years' rotation is, as I have attempted to show, a more profitable investment for land-owners than sheep farming on the same land, where the rental is not often 2s. 6d. per acre, after the expense of erecting buildings.

It puzzles the writer why such low prices are given for the magnificent timber grown in the Highlands. The transport difficulties are of course many and freights excessive, still the quality of the timber warrants higher prices. Meantime I think it would be advisable to make pit-wood the principal crop in the Highlands; that produced in the Highlands is the toughest of its kind, being reared mostly on exposed situations.

Wood distilling is another way in which the smaller or coppice wood was used. This is still carried on, but not nearly on such a large scale as formerly. Bobbin or thread reel making also was a means of utilising birch wood, but this industry has taken wings too. A fairly good market is still available for birch twigs, which are used in the manufacture of steel in the rolling mills. It may here be mentioned that good coppice wood is now much more difficult to get, as rabbits and sheep prevent it passing beyond even the bush stage. The former are undoubtedly the worst enemy the forester has to contend with, and since 1843, the date on which they were first introduced into this country, they have proved a great hindrance to the growing of trees; in fact, so numerous have they become that they have been the means of decreasing the value of grazing land.

A system of light railways with improved canal or waterways would do much to enhance the value of Highland timber. Water is plentiful throughout the Highlands, and if it could be harnessed for power would prove very useful.

One bright speck has appeared on the horizon in the shape of the new Forestry Commission, which is composed of men of matured experience in forestry, and to them we look to stimulate this decaying Highland industry. Tree-growing on broad and commercial lines, which would assist greatly towards reinstating a fast disappearing population, is an urgent necessity. Let our legislators not forget that what is suitable for the Lowlands may be quite unsuitable for the Highlands.

Britain imports or pays away to foreign countries about £70,000,000 for timber, or about 18,000,000 tons. I would suggest a slight tariff of say 6d. per ton on each ton imported, the proceeds of the tariff to be devoted to the help of both Government and private growers of home timber. This tariff would amount to £450,000, at 6d. per ton.

24. The Bin Wood, Aberdeenshire.[1]

The Bin Wood, Huntly—one of the most noted "ripe" woods in Scotland during the war—was the subject of a thoroughly practical address by Mr John Rule, forester there to the Duke of Richmond and Gordon, to the members of the Aberdeen Branch of the Royal Scottish Arboricultural Society, last year. Mr A. Forbes Irvine of Drum, the president, was in the chair.

The Bin Wood, Mr Rule stated, covered two distinct hills, 800 and 1037 feet high respectively, 2258 imperial acres in extent, and to go round it one would have to travel 11 miles over rough ground. The Bin Wood had not been cut before its time, like many of the woods throughout the length and breadth of the country, but at the mature age of eighty years. It had been a great asset to the nation in the part it had taken in the great war. The planter of eighty years ago never thought his seedlings would ultimately be timbering the trenches in a world conflict. What could a bleak, rocky moor have done in such an emergency? The Bin Wood's uses to the locality had been many and varied in affording shelter and amenity, supplying wood for all the needs of a wide agricultural district, its by-products, such as brushwood and "rosity roots," having been a godsend to the people of the district, and especially to the poor of the town of Huntly. The wood had always been a happy hunting ground for the "birn wife" and the tinker.

But by far the greatest benefit of the Bin had been the lucrative employment it afforded to many people. This might be compared with the state of matters had it been allowed to remain unplanted. Including planters, at least twenty men, on an average, had, in one way or another, found regular employment during the last eighty years. Replanting had been carried on for the last fifteen years, and already parts of the rugged hill were beginning to have quite a wooded appearance. He had endeavoured to show how a bleak, rocky moor could be turned to good account for all concerned, and it was the country's saddest mistake that there were not more Bin Woods in it.

In the discussion that followed, Mr John Michie, M.V.O., formerly forester and factor to the King on the Balmoral

[1] This summary is taken from the *Aberdeen Journal* for 15th December 1919.

estates, expressed approval of Mr Rule's system in regard to the replanting of the Bin Wood where it had been cut, pointing out that in forestry, as in agriculture, a rotation of crops was desirable, larch following Scots pine, or spruce being planted in the wetter portions.

Mr Rule, in answer to Mr George Wyllie, forester at Ballogie, Aboyne, said that at the time the Bin Wood was planted comparatively little attention was being paid to the best methods of forestry, or the Bin could have carried double the crop planted.

Mr Sydney J. Gammell of Countesswells emphasised the importance of greater attention being paid to natural regeneration of the woods of this country, since he feared that the initial cost of replanting at present-day expenditure would be ruinous to proprietors.

Sir John R. Gladstone, Bart. of Fasque, spoke of the importance of having cattle and sheep on the forest trampling in the seed when natural regeneration of the woodlands was contemplated, and referred to the success which had attended this method in Glendye.

On the motion of the chairman, Mr Rule was heartily thanked for his interesting and practical paper.

25. British Empire Forestry Conference.[1]

The Forestry Commission arranged a Conference, which took place in July 1920, with forestry delegates from all parts of the British Empire where forestry is represented. The main object was to discuss questions of forest policy and to afford an opportunity for the interchange of views on technical problems and methods. Forty-three delegates assembled in London in July, and sat in committee on 12th, 13th, 14th, 20th, and 21st, and in full session on 7th and 22nd July.

In order to enable the delegates to see the present condition of home forests and forest industries, a detailed programme was prepared and arrangements were made to visit various parts of the United Kingdom. On these excursions much mutual benefit was received by the exchange of views and experiences between the home foresters and the foresters of the Empire.

[1] The *Resolutions* of the Conference are published by H.M. Stationery Office (Cmd., 865, price 3d. net), and may be obtained at 23 Forth Street, Edinburgh.

After the full consideration of various questions in committee and general meetings the Conference, sitting in full session on 22nd July, adopted the following resolutions, which the delegates will bring to the notice of their respective Governments :—

1. *Forest Policy.*—In view of the great importance to the Empire as a whole, as well as to each of its component parts, of producing a sustained yield of all classes of timber, and of encouraging the most economical utilisation of timber and other forest products, and of maintaining and improving climatic conditions in the interests of agriculture and water supply, each of the Governments of the Empire should lay down a definite forest policy to be administered by a properly constituted and adequate forest service.

2. *Survey of Resources.*—The foundation of a stable forest policy for the Empire and for its component parts must be the collection, co-ordination and dissemination of facts as to the existing state of the forests and the current and prospective demands on them.

3. *Constitution and Status.*—In order to attain continuity in the development of forest resources, it is desirable that certain elements of stability be secured in the constitution of the forest policy. This may be done by the following measures :—

(1) The definition, where this has not been done already, of forest policy in a Forestry Act or Ordinance.

(2) The reservation for the purpose of economic management and development of forest land under conditions which prevent the alienation of any which is primarily suitable for forests, except for reasons consistent with the maintenance of the forest policy as a whole.

(3) The assurance to the Forest Authority of funds sufficient to carry out the accepted policy for a series of years.

(4) The grant to members of the forestry service of the status of civil servants with due provision for pension.

(5) The appointment as the chief officers of the forestry service of persons having a high standard of training in forestry, their selection and promotion being by merit alone.

(6) The establishment in each of the larger parts of the Empire and for the Colonies not possessing responsible government collectively, of an officer, or officers,

having special duties of advising as to forest policy and surveying its execution.

4. *Organisation of Forest Industries.*—It is extremely desirable that the Forest Authority should be in close touch and consultation with organisations representing the interests concerned in the extraction and utilisation of timber and other forest products.

5. *Publicity.*—It is the duty of the Forest Authority in every part of the Empire to adopt and encourage methods of education and publicity in order that the people may be fully informed of the aims and purposes of forest policy, and may thus be induced to co-operate towards its successful fulfilment.

6. *Distribution of Forest Plants.*—The Conference have had brought to their attention the advantages which have accrued in several parts of the Empire from the wide distribution of forest plants, and desire to bring the method of encouraging tree-planting by distribution of plants either from Government or private nurseries gratuitously or at cost price to the earnest attention of their Governments.

7. *Terminology and Trade Nomenclature.*—The following questions should be referred to the proposed Imperial Forestry Bureau immediately on its formation :—

(i.) Standardisation of forest terminology ;

(ii.) Correct identification of timbers, and standardisation of their trade names.

8. *Research.*—The scheme of research work set out receives the approval of the Conference, and is recommended to their Governments for early consideration and approval by them.

This takes the form of the report from a committee appointed "to prepare a draft scheme for the organisation of that research work which is essential to the progress of forestry, including both the production and utilisation of forest produce, the committee to pay particular regard to the importance of avoiding overlapping and of co-operation with existing institutions." The report deals with the organisation and sub-division of research, with the relation of the different parts of research to one another and to education and practice, and with the subjects of research both generally and in relation to the needs of the different parts of the Empire.

9. *Education.*—It should be a primary duty of Forest Authorities throughout the Empire to establish systematic

schemes of forestry education. It has been found for climatic and other reasons that it would not be possible for each part of the Empire to establish a complete scheme of forestry education of its own, and therefore it is essential that those parts of the Empire which are willing and able to establish complete systems should, as far as possible, frame such schemes with a view to combining for meeting the needs of those parts which can only themselves make a partial provision for their requirements.

Part of this subject has been dealt with by a committee whose report, which refers mainly to the higher training of forest officers, is approved by the Conference.

The main principles embodied in this report are as follows:—

(1) That one institution for training forest officers be established in the United Kingdom.

(2) That students be selected from graduates having taken honours in pure or natural science at any recognised university.

(3) That it be an integral part of the work of the institution to arrange supplementary courses at suitable centres for students requiring special qualifications and also special courses for forest officers from any part of the Empire, whether at the institution itself or at centres of training in other parts of the world. The Governments should recognise these courses as part of the ordinary duties of the forest officer, at any time during their service, and the Governments concerned should give special facilities to forest officers in their service to attend such courses.

(4) That a Department of Research into the formation, tending and protection of forests be associated with the training institution.

(5) Encouragement should be given to the existing provision made by universities and colleges for forestry instruction for those who do not desire to take the full course suggested for the forestry service. It appears that this is especially applicable to the United Kingdom.

It is also desirable to make adequate provision for woodmen's schools for the training of foresters as distinct from those which are intended for forest officers.

10. *Forestry Bureau.*—The Conference approve the suggestions

and recommendations for the constitution of an Imperial Forestry Bureau which are contained in the report of a committee, and strongly urge upon their respective Governments that they should contribute to the support of the Bureau as therein suggested. They feel that it will be largely upon the work of such a Bureau that the proper development of the forestry resources of the Empire will depend, and they therefore cannot overemphasise its importance as a part of Empire organisation.

11. *Future Conferences.*—The Conference is convinced that the holding of conferences of representatives of the Empire on forestry matters is of great service. They desire to thank the Forestry Commission of the United Kingdom for causing the Conference to be assembled, and for making the necessary arrangements. They recommend that the next Conference be held in the year 1923, and that, if the Dominion Government approves, it be convened in Canada.

26. Forestry Exhibition at Highland and Agricultural Society's Show, Aberdeen, 20th-23rd July 1920.

Following the practice for some years past, the Royal Scottish Arboricultural Society again held an exhibition at the Highland Show. The fact that the district in which the Show was held is one of the largest timber-producing areas in Scotland, might have warranted one to anticipate a large display of forest products. This hope was not realised in the section for articles in competition, in which the small number of entries was somewhat disappointing. The section for articles for exhibition was, however, very creditable, several exhibits being highly interesting and instructive. The premier place in this section was well awarded to Messrs A. & G. Paterson, Ltd., Wood Merchants, Banchory, for a varied collection of round and sawn timber. This exhibit included several mature coniferous trees shown in their full length, notably one specimen of *Abies grandis* nearly 90 feet long and containing 82 cubic feet, age 40 years, grown at Durris, some fine grown larch and Scots pine, and a well-grown specimen of *Thuja gigantea.* The sawn timbers included some very fine specimens of Douglas fir and other species. The same firm also exhibited a wooden cottage, composed entirely of home-grown timber, consisting of three good apartments, one of which was furnished by Messrs James

Allan & Company, Cabinetmakers, Aberdeen, with a Queen Anne dining-room suite complete, made from home-grown oak, inlaid with mahogany and satinwood, for which the judges awarded a Silver Medal. Messrs J. & A. Ogilvie, Cabinetmakers, Aberdeen, contributed several articles of furniture, all made from home-grown timber. Messrs Paterson also exhibited examples of various sizes of pit-wood, and many very interesting articles made from small wood, as well as photographs, and examples of the destructive work of squirrels on Scots pine.

A very neat and useful hut was shown by Messrs John Bisset & Sons, Ltd., Wood Merchants, Aberdeen. This was made in sections and could be erected in a couple of hours, and consisted of one apartment with room for a bed, table, and useful press, with stove complete. This exhibit was much admired for its neatness and commodiousness. It is understood that the price complete was £95.

Several other highly interesting examples of forest produce were shown from Balmoral, Glendye, Braemar, and Fyvie Castle estates; and the display of specimens from the Forestry Museum, Marischal College, kindly lent by Mr P. Leslie, M.A., B.Sc., Lecturer on Forestry, added much to the educational interest of the Show.

Mr John Maughan, Estate Office, Jervaulx Abbey, exhibited a very ingenious standard calliper for measuring the diameter or quarter-girth of standing trees at a height of 15 feet or more from the ground. It can be taken to pieces for convenience and safety when travelling, and is secured by a single bolt.

One cannot overlook the exhibits in the competitive section sent in by Mr H. R. Munro, Estate Office, Charborough Park, Wareham, Dorset, which consisted of specimens demonstrating the beneficial effects of good as compared with bad pruning, and a collection of fungi injurious to forest trees. The latter was a highly meritorious collection, neatly prepared and correctly named, and elicited general admiration.

The general appearance of the exhibition was much improved by the neat and tasteful displays of growing plants of conifers and ornamental shrubs exhibited by Messrs W. Smith & Son, and Messrs Ben. Reid & Company, Nurserymen, Aberdeen.

The following are the awards of the judges, Sir John Fleming, of Dalmuinzie, Messrs Gilbert Brown, Grantown, and Frank Scott, Inverness:—

Competitive Section.

Classes 1, 2, 3, 5 and 6.—Planks of Scots pine, Norway spruce, larch, oak, and ash. 1st Prize: The Earl of Mansfield, Scone Palace, Perth, per Mr Wm. Leven, forester—£5.

Class 17.—Specimens demonstrating the beneficial effects of good as compared with bad pruning. 1st Prize: Mr H. R. Munro, Estate Office, Charborough Park, Wareham, Dorset—No. 1 Silver Medal. 2nd Prize: Mr James M'Hardy, Lundin and Montrave Estates, Fife—No. 3 Silver Medal.

Class 19.—Collection of fungi injurious to forest trees and shrubs. 1st Prize: Mr H. R. Munro, Estate Office, Charborough Park, Wareham, Dorset—No. 1 Silver Medal.

Articles for Exhibition.

1. To Messrs A. & G. Paterson, Ltd., Silverbank Sawmills, Banchory, for comprehensive series of exhibits of home-grown wood, and their products (embracing trees of splendid growth and dimensions), graded pit-wood, railway timber and scantling, and various manufactured articles including a completely equipped sectional cottage—Gold Medal.

2. To Messrs John Bisset & Sons, Ltd., Timber Merchants, Aberdeen, for furnished hut of special design—No. 3 Silver Medal.

3. To Messrs Wm. Smith & Son, Nurserymen, Aberdeen, for model of Bell's improved safety seed kiln—No. 2 Silver Medal.

4. To Mr John Maughan, Estate Office, Jervaulx Abbey, Middleham, Yorkshire, for arbormeter for measuring the diameter or quarter-girth of trees at a distance from the ground—No. 3 Silver Medal.

5. To Mr Alexander Murray, Dreghorn Mains, Colinton, for lever-releasing transplanting boards—No. 3 Silver Medal.

6. To Messrs Ben. Reid & Co., Nurserymen, Aberdeen, for canvas shelter, transplanting boards and stand—No. 3 Silver Medal.

7. To Messrs James Allan & Co., Cabinetmakers, Aberdeen, for Queen Anne dining-room suite complete, made from home-grown oak inlaid with mahogany and satinwood—No. 2 Silver Medal.

C. S. F.

27. Excursion of the Aberdeen Branch to Glendye Woods.

On the invitation of Sir John Gladstone, Bart. of Fasque, the members of the Aberdeen Branch of the Society to the number of seventy held an excursion on Saturday, the 26th July 1919, to Glendye. The parent Society was officially represented by Mr R. Galloway, S.S.C., Secretary of the Society.

The party proceeded by train to Banchory station, where they were met by a number of motor cars which conveyed them to the estate. The first stoppage was at the Templeton wood, where the party were joined by Sir John Gladstone and the forester, Mr Neil Macgregor. The Templeton wood is a middle-aged plantation of Scots pine adjoining a large tract of heather moorland, where a splendid crop of young Scots pine has made its appearance within recent years. The success of the regeneration is attributed to the trampling and wounding of the ground by a flock of sheep which had been folded on the area a few years previously. In this way a good germinating surface was provided for the seed blown from the Templeton wood, and a large number of seedlings were enabled to get a start. After a visit to the sawmills of Messrs Black—who had been cutting pit-wood for a number of years on the Bogarn woods—the party proceeded to the Smithy wood, where a number of plots were planted 5 or 6 years ago with the semi-circular spade. The ground here is very diversified, both as regards surface vegetation and soil, and an effort was made in laying out the plots to grow species suited to each type of locality. On the drier slopes with a covering of heather and grass the plots consist of larch, Japanese larch, and Douglas fir, and on the lower ground, partly covered with rushes, where the soil was wet and had to be drained before planting, the group consisted chiefly of Sitka spruce. The Sitka spruce and some of the Japanese larch were damaged by frost in 1918, but when the canopy closes, it is expected that there will be no risk of the trees being injured in this manner, and that the plantations will make rapid growth.

The estate nursery, which has been established for many years, was then visited. The nursery is kept in first-class condition, and is protected by a hedge surrounding it on the outside and by a number of interior hedges. The seed beds and transplant

lines are well stocked with Scots pine, larch, spruce, and with several species of American conifers, including Douglas fir, Sitka spruce, and smaller quantities of *Abies grandis* and *Larix occidentalis*. On leaving the nursery the party walked to the Bridge wood, composed of old larch and Scots pine. Throughout the wood there are clumps of younger growth, chiefly Douglas fir, in places where the old timber had been partially cleared, and the Scots pine is underplanted with the same species. Sir John Gladstone, in describing the history of the wood, said that in 1898 the Scots pine and larch were showing signs of falling off in growth, and his father decided to have the timber cut. On his representation, however, it was decided to postpone the cutting of the wood, and it was underplanted instead, and filled up with Douglas fir. The result was that the old trees recovered their vigour of growth in a remarkable fashion. They had now attained to large dimensions, and the increment was still good. Measurements had been made by the forester of the rate of growth of the Douglas fir planted in the more open areas. These measurements showed that the increment for the past 5 years had been at the rate of 230 cubic feet per annum, while the mean annual increment from 1898, when the trees were planted, was at the rate of 113 cubic feet per annum.

After inspecting this wood the company were entertained to luncheon by Sir John Gladstone, the annual business meeting being held afterwards. The Chairman—Mr A. F. Irvine of Drum—presided and offered on behalf of the Branch their sincere thanks to Sir John for his hospitality. Sir John said that there was nothing extraordinary to show the members on the estate of Glendye, but he was very glad to do what he could to make the visit interesting. There was one curious document he wanted to show them—an account of the planting of the Sawmill wood which had just been inspected. Reading from the account book he said the planting commenced in 1857 and finished in 1858, 342 acres being planted with larch and Scots pine at 5-foot intervals, and the planting and fencing of the whole cost £361.

In the afternoon the party first visited the arboretum, which is situated in a hollow by the banks of the river Dye near Glendye Lodge. The different species, which are chiefly coniferous, have been skilfully planted out in groups, and the effect is very imposing. The large number of fine silver firs,

including specimens of *Abies pectinata*, *A. grandis*, *A. cephalonica*, *A. concolor*, *and A. Lowiana*, attracted much attention.

Thereafter the inspection of some of the other plantations on the estate was proceeded with, including a 29-year-old Japanese larch wood, situated at an elevation of 700 feet with 1540 trees per acre, of an average volume of 920 cubic feet quarter-girth measurement. Several plots which had been measured by the Interim Forestry Authority were also seen in the other woods which were inspected in the course of the day. These included the Sawmill wood at an elevation of 500 feet above sea-level, with 170 spruce trees per acre of an age of 66 years, having an average volume of 6115 cubic feet quarter-girth under bark measurement; the Heathery wood of Scots pine, with 235 trees to the acre of 76 years of age, at a similar elevation, with 3390 cubic feet quarter-girth under bark measurement; and the Fumery wood of spruce, 54 years of age, at an elevation of 350 feet, with 305 stems to the acre, having an average volume of 5965 cubic feet under bark.

28. Hylecoetus or Lymexylon dermestoides (L.).

(*With Plates.*)

By Donald C. Fergusson, M.C., B.Sc.

Some notes and observations on this comparatively rare species of beetle, which I found last summer in considerable numbers at Balquhidder and Dunkeld, may prove interesting and helpful to our foresters. I found the larvae at work in stumps of larch, spruce, Scots pine, and Spanish chestnut, and in logs of birch, beech, and gean. Larvae were also taken from a thick broken branch of birch. There are continental records also on the stumps of silver fir, alder, oak, and *Acer*. *Hylecoetus* belongs to the Family Lymexylonidae, a family of saw-horned beetles with some relationship to the click beetles, the insect-eating Cleridae, and the furniture beetles.

Hylecoetus dermestoides has an elongate body which in fresh specimens shows a yellow pubescence. The head is large and carries a pair of eleven-jointed antennae, and the eyes are prominent. The legs are slender and the seven-jointed abdomen is quite covered by the wing-covers. The males

FIG. 1. LARVA OF HYLECOETUS DERMESTOIDES.
Magnified 2½ times.

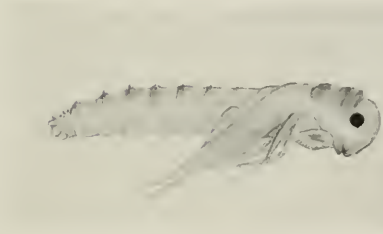

FIG. 2. PUPA OF HYLECOETUS.
Twice natural size.

[*To face p.* 192.

FIG. 3. WORKINGS OF HYLECOETUS ON BIRCH.
One-half nat. size.

FIG. 4. WORKINGS OF HYLECOETUS ON LARCH STUMP.
One-third nat. size.

are smaller than the females, but there are other distinct differences; the male is proportionately narrower and the female broader; the wing-covers of the male are brownish yellow but black towards the apex (sometimes all black), in the female the wing-covers are brownish yellow and the breast and eyes are black. A very characteristic feature of the male is the presence of a tuft or fan-like projection on the second joint of the maxillary palps. There is considerable variation among the adults, some dwarf forms resulting from under-feeding, but generally the male may be said to measure from 6 to 13 mm., and the female from 9 to 16 mm.

Larva.—The larva of *Hylecoetus* (Plate XIV. Fig. 1) cannot be confused with that of any other forest insect. When full grown it measures from 15 to 24 mm., the largest I measured. The head is smooth and is provided with strong gnawing mandibles, but no antennae are present. The three joints of the thorax are strong, especially the first, which is much enlarged and arched, and has a coarsely granular horny plate on its upper surface. Each joint of the thorax carries a pair of legs. There are nine abdominal joints. A very characteristic feature is the last joint of the body which is prolonged into a tail-like process, forked at the tip and provided with two rows of chitinous teeth which are directed slightly backwards. The larval gallery is not widened all the way to the exterior, and this tail is used for pushing the frass through the little hole in the outer layer of bark. Galleries exposed by removing the bark are immediately plugged by the larvae, but a narrow passage is left through which the tail may be seen projecting when bore-meal is being expelled. The colour of the larva is whitish yellow.

Pupa.—The pupa, which is found in the burrow made by the larva, measures up to 14 mm. Its general form and appearance can be seen in Fig. 2. There are spines, the apices of which are turned forwards, on the upper surface of each segment of the abdomen. These spines aid the pupa in retreating down the gallery if molested. The wing-covers, wings, and legs are free, *i.e.* are not glued down to the body.

Life-history.—The generation is normally an annual one. The adult beetles issued in May and June, and after pairing the females, in my observations, laid their eggs in June and July. The eggs are laid singly in crevices of the bark. In

several interesting examples on larch stumps, I found the eggs laid all round the circumference on the exposed cambium ring. In these special cases, the larvae on hatching tunnelled downwards for several inches between the bark and wood before beginning their gallery in the wood, afterwards making a separate side gallery that pierced the bark for the removal of frass. Whether or no in more normal cases branch galleries are made to the outside for the evacuation of frass remains for further observation. There is, at any rate, a continued throw out of the bore-meal in the form of pellets, so that the little heaps of white saw-dust which draw the forester's attention to the work of the larvae are not just the result of a boring for entrance. The actual entrance hole is very small and may easily be overlooked, even in smooth-barked trees. The course of the larval gallery varies considerably; in birch, for example, the larvae tunnelled between the wood and bark for more than 8 inches before bodily entering the wood (Plate XV. Fig. 3). In larch, the galleries were confined to the outermost ten rings of wood, and the galleries, which are somewhat curved or bow-like, followed roughly the direction of the annual rings (Fig. 4). In beech, the larvae tunnelled for 7 to 12 inches into and almost at right angles to the wood.

Winter is passed in the larval condition, full size having not yet been attained. In spring, the larva resumes gnawing and there is a renewal of the out-throw of frass. When almost ready for pupation the larva turns in its tunnel, and makes its way towards the bark, often filling the gallery behind it with frass. Pupation takes place in that part of the gallery nearest the bark; in thick-barked material the pupal chamber may be entirely in the bark. When ready the beetles enlarge the hole, usually the original entrance, in the bark, and escape into the open.

Puton suggested that the larvae of *Hylecoetus* were really useful, their diet being a carnivorous one of harmful bark-boring grubs. No proof exists for this opinion, although a *Hylecoetus* larva destroyed six *Myelophilus piniperda* grubs which I introduced into its gallery.

From an economic standpoint the larvae working in stumps do no harm, yet several times I found them in felled logs. In such cases they would spoil the wood for technical purposes. As eggs are only laid on material that has still the bark on,

the treatment in case of the insect becoming harmful would be the barking of all felled stems.

Two natural checks to the increase of this beetle were noted. The little beetle *Rhizophagus dispar*, present in large numbers, was destructive to eggs, and larvae. The greater-spotted woodpecker destroys the pupae. Traces of the work of the woodpecker were very evident in the case of beech logs, and examination of the workings revealed the empty pupal beds.

29. Trees in Myth and Legend.[1]

By Ernest V. Laing, President of the Aberdeen University Forestry Society.

1. It is proposed to deal in the course of this paper first with the attitude of our ancestors and the Ancients towards trees, and the effect which trees had on the general trend of the lives of men, and secondly, briefly and in a general way, with a few of the myths and legends connected with some of our best-known trees, and to try to show how a knowledge of tree lore and a greater cultivation of interest in trees and their habits might affect men beneficially, more especially those engaged in forestry work.

2. Mankind in its attitude towards trees may be broadly divided into two great classes. In the first place, there are those who treat trees to a greater or less extent from a commercial or scientific point of view, and, in the second place, there are those who regard trees more or less from an aesthetic standpoint. Under the latter group, namely the aesthetic group, may be classed those who love or admire trees, and those, primitive people it may be, who worship trees. It is more particularly with the latter, namely worshippers of trees, with whom we have to deal.

3. The portion of humanity which regards trees purely from a utilitarian aspect, is after all a comparatively small one. Trees to most people are of interest aside from their scientific or utilitarian value. The majority view trees as elements in the world of beauty out of doors. "I am not surprised that the

[1] A paper read to the University of Aberdeen Forestry Society, on 15th November 1919.

Ancients worshipped trees. Lakes and mountains however glorious for a time, in time weary — sylvan scenery never palls." So wrote Lord Beaconsfield in 1880, a few months before his death.

This love for trees may be engendered through associations and memories of early childhood, through constant association and living in a sort of communion with trees, as Keats has so well expressed in the lines—

> "The trees
> That whisper round a temple become soon
> Dear as the temple's self,"

or brought about by the feeling of wonder and awe inspired by beautiful tints, graceful outlines, or giant proportions. In this, however, we have admiration rather than love displayed; admiration for something which is beautiful, artistic, splendid; something which in its size and grandeur is capable of casting a spell over the beholder. After all there is a wide gulf between the man who loves trees either with the love of an artist for the beautiful or the love engendered by memory and association, and the man who is admiring something which he has never seen before equalled in strength or beauty. To illustrate this distinction between the lover of trees and the admirer of trees we may take the recorded incident of Xerxes and the celebrated Phrygian Plane.

When Xerxes set out on his Grecian expedition, his route led him near a noble specimen of an Oriental Plane which grew in Phrygia. It is recorded that this plane was of immense size, unfortunately the dimensions are not stated, and Xerxes was so struck with it, having never before seen such a majestic tree, that he ordered his army to halt for three days that he might pitch his tent under its spreading branches. The part which this sylvan giant played in the history of Greece is well known, for during the time Xerxes was under its spell, the Greeks were getting the defences of Thermopylae into order. There was no love on the part of Xerxes for this plane, for he had never seen it before, but he admired it simply because it was something greater among trees than he had been acquainted with.

4. Both this love and admiration for trees must be present, we should think, in the breasts of all men. The Ancients, and many primitive peoples too, must, although probably not cognisant of the fact, have possessed feelings of love and

admiration for trees, but what factor or factors was it which led or do lead men to regard trees as holy and to worship them? In tree-worship we have got something more present, and it is that something which constitutes the fundamental difference between lovers and admirers of trees and worshippers of trees.

In the first place, the worshipper of trees regards the tree as being a conscious personal being. The step from loving and admiring trees to worshipping trees is a retrograde though easy one, and tree-worship is only to be found among plain and simple peasants savouring still of antiquity and among the Ancients. Science and knowledge have made us lose the conception which some primitive people hold, and the Ancients had, that trees were conscious personal beings. We have lost the animistic theory of nature held by primitive man, which arose through his having reached a stage of thought in which having discovered some animating principle in himself, he endowed all other living creatures and also inanimate things with this, and ascribed to them a personality equal to his own.

The second factor which may have contributed to tree-worship was the size attained by many trees. Size in anything will always impress the mind of man, and more especially primitive man. We are cognisant of the effect which a sylvan giant has on civilised man: how much more then would it affect a being whose mind is so open to external impressions and whose imagination is so vivid?

Thirdly, add to the grandeur of individual trees their quality of longevity, and the idea of immortality associated with trees, a god-like attribute, any organism possessing which was a fit subject for veneration. The idea of the immortality of trees was expressed by A. P. de Condolle in the beginning of the nineteenth century. He stated that trees do not die of senile decay, but only as the result of injury or disease. Trees, he affirms, are constructed on a plan fundamentally different from that underlying the structure of the complex human organism, and are endowed with a sort of potential immortality. At any rate, apart from any scientific explanation as to whether trees are immortal or not, we have evidence of trees living to an immense age. There is exhibited in the Natural History Department of the British Museum a section of a trunk of one of the mammoth trees of California (*Sequoia gigantea*), showing on its polished

surface 1335 rings of growth, which, if we are to assume that each year the tree produced a single ring, would make the tree 1335 years of age when it was felled. Many oaks are known to have attained an age of well over 1000 years. We can understand how primitive minds would regard a tree under which their ancestors had lived for hundreds of years as immortal, and how readily they would look on that which to them is with them always as a sort of guide and as having some influence on their own lives and all that belonged to them.

The fourth element which may serve to explain tree-worship was the healing or harmful properties of trees. The twigs and leaves and bark, for example, were supposed to be the gift of the indwelling spirit or demon, according as they were beneficial or malignant to the receiver. The tree providing harmful substances was to be avoided; the one providing healing substances was to be revered, and sacrifices offered in thanksgiving to the inhabiting god for his goodness. This is particularly seen in the case of the so-called "Tree of Life," or *arbor vitae*, of many different countries. The tree of life or immortality occurs in many mythologies—Norse, Malayan, Chinese and Polynesian. The fruit of the Chinese "tree of life" is given by fairies to their favourites, and they then become immortal; in Polynesia the dead assemble on a huge tree with dead and living branches. Only those who tread on the living branches come back to life. The Malayans think that the mystic tree of life grows on the summit of one of their mountains (Mt. Kina Balu), and that its fruit bestows immortal youth. All such wonderful trees may be conceived of as nothing more than imaginative extensions of the use of plants and herbs and leaves of trees in the medicinal lore of all races, aided, too, by the universal custom of tree-worship.

5. Tree-worship may take two forms. Either the tree may be worshipped as the god itself, or, as is more common in mythology, the tree may be regarded not as being inhabited like man by its own proper life and soul, but as possessed like a fetish by some other spirit which has entered it and used it as a body. The subject is an obscure one, whether from the lower races not having definite opinions about it, or from our not finding it easy to trace them, but the fact remains that tree-worship in one form or another was prevalent among the Ancients, and is still prevalent among primitive peoples.

The Buddhist books show clearly that in the early days of their religion it was a matter of controversy whether trees had souls, and, therefore, whether they might lawfully be injured. Orthodox Buddhism decided against the tree-souls, and consequently against the scruple of harming them, declaring trees to have no mind or sentient principle, though admitting that certain spirits do reside within the bodies of trees and speak from within them.

When we consider the doctrine of the transmigration of souls, we find that it clearly recognises the idea of trees being animated by human souls. The soul of Buddha himself was forty-three times in all in a tree.

Again, when a tree springs from a grave, it was assumed to be tenanted by the departed spirit or to be actually the dead man himself living once more in the form of a tree. This is confirmed by the common belief held by English peasants that the tree cries and bleeds when it is cut. So the bushes which grew on the grave (barrow) of Polydorus bled when Aeneas plucked them up, like Dante's trees in the Inferno. Actual instances of the belief that sacred trees are the dead transformed, or are the habitation of the ghost, are found in Australia and the Philippine Islands, where it is affirmed that the good are transformed into trees at death.

6. Whether a tree is looked upon as inhabited, like a man, by its own proper life and soul, or as possessed by some other spirit which has entered it and uses it as a body, is hard to determine, but is really immaterial. The conceptions of the inherent soul and of the embodied spirit are but modifications of one and the same deep-lying animistic thought. The belief in tree-spirits and the practice of tree-worship involves notions more or less coinciding with that of tree-souls, as when the south-eastern Asiatic prays before cutting down a tree, the tree being considered as having a demon or spirit. Africa shows us well-defined examples of the idea of tree-spirits. The negro woodman cuts down certain trees in fear of the anger of their inhabiting demons, but he finds a way out of his difficulty by a sacrifice to his own good genius; or when he is laying in the tree, and its indwelling spirit comes out to chase him, he cunningly drops palm oil on the ground, and makes his escape while the spirit is licking it up. The demon is then pacified, and the work can be proceeded with. In Africa, too, we find

that trees are prayed to, and sacrifices offered, in times of sickness. A negro was once worshipping a tree with an offering of food, when someone pointed out to him that the tree did not eat; the negro answered, "O, the tree is not a fetish; the fetish is a spirit and invisible. Certainly, he cannot devour our bodily food, but he enjoys its spiritual part and leaves behind the bodily, which we see." In Esthonian districts during the last century, the traveller might often see the sacred tree, generally an ancient lime, oak, or ash, standing inviolate in a sheltered spot near the dwelling-house, and old memories are handed down of the time when the first blood of a slaughtered beast was sprinkled on its roots that the cattle might prosper, or when an offering was laid beneath the holy linden on the stone where the worshipper knelt on his bare knees, moving from east to west and back, which stone he kissed thrice when he had said, "Receive the food as an offering." It may well have been an indwelling tree-deity for whom this worship was intended, for folk-lore shows that the Esths recognised such a conception with the utmost distinctness. The Siamese believe that by offering cakes and rice to the tree before felling it, the propitiated spirit passes into the boat made from its former residence and becomes its guardian spirit. The North American Indians of the Far West entering the defiles of the Black Mountains of Nebraska will often hang offerings on the trees, or place them on rocks, to propitiate the spirits and procure good weather and hunting. In South America, Darwin describes the Indians offering their adorations by loud shouts when they came in sight of the sacred tree standing solitary on a high part of the Pampas, a landmark visible from afar. In this tree, he relates, were hanging by threads numberless offerings such as cigars, bread, meat, down to the mere thread pulled from the poncho by the poor wayfarer who had nothing better to give. Men would pour spirits and wine into a certain hole and smoke upwards to gratify Walleechu, as the god was called, while all around lay the bleached bones of the horses slaughtered as sacrifices. Darwin reasonably judges on this evidence that it was to the deity Walleechu that the worship was paid, the tree being only his altar; but he mentions that the Indians are believed by some to consider the tree as the god itself.

The peasant folk-lore of Europe still knows of willows that weep and bleed and speak when hewn; of the fairy maiden

that sits within the fir tree. One may still look on where Franconian damsels go to a tree on St Thomas's Day, knock three times solemnly, and listen for the indwelling spirit to give answer by raps from within what manner of husbands they are to have.

These are a few examples chosen at random of the beliefs of primitive peoples, and serve to show to some extent their faith in the god-like attributes of trees, or the power over their fortunes, which the indwelling spirits of the trees possessed.

7. Such animistic beliefs have survived in the East in actual tree-marriage for a symbolical or ceremonial purpose. The idea at the root of this custom is that the tree is capable of taking ill-luck to itself. Thus in the Punjab if a man has lost several wives in succession he is married to a tree before the actual marriage; the tree is then assumed to die in the place of the woman. Other cases are known with the same purpose of diverting some particular ill-luck to the tree-bride. Again many tribes in India observe the custom of marrying both bride and bridegroom to trees as a preliminary ceremony; perhaps to divert all evil influences to them, or possibly with a view to obtaining good luck from them. Whatever be the rationale of such rites it is clear that they could never have arisen except on the assumption that the tree was actually likened to a man, and that actual unions between men and trees had once taken place.

So far, then, it has been attempted to show the attitude of primitive peoples towards trees. We have seen that the tree may be worshipped as the god itself; or the tree may have the spirit or demon embodied in it, as in the transmigration of souls theory; or the tree may be the spirit's perch or shelter or favourite haunt. The tree may be sacred simply because it is the altar of some god, a place at once convenient and conspicuous where offerings can be set out for some spiritual being who may be a tree-spirit or perhaps the local deity, living there just as a man might do who had his hut and owned his plot of land around.

The tree may be the place of spiritual resort, and as such there is no real distinction between the sacred tree and the sacred grove. The shelter of some single tree or the seclusion of a forest grove is a place of worship set apart by nature; of some tribes, the only temple; of many tribes, perhapst he earliest.

It is interesting to note that the first trace of forest protection consists in that afforded to sacred trees and groves. We read of such groves in the Bible and in Tacitus, and they still exist in India, especially in the hill districts of Assam. Nowhere perhaps in the world in these modern days is the original meaning of the sacred grove more picturesquely shown than among the Mundas of Chota-Nagpur, in whose settlements a sacred grove of sal-trees, a remnant of the primeval forest spared by the woodman's axe, is left as a home for the spirits, and in this hallowed place offerings to the gods are made. Interference with them is a capital crime.

With Christianity, however, comes a crusade against the holy trees and sacred groves, but in spite of stringent measures taken to eradicate such places, within the last two centuries there were old men in Gothland who would go to pray under a great tree as their ancestors had done in their time; and to this day the sacrificial rite of pouring milk and beer over the roots of holy trees is said to be kept up on out-of-the-way Swedish farms. Names like Holy oake and Holy rood record our own old memories of the holy trees and groves, memories long lingering in the tenacious peasant mind; while it was a great and sacred lime tree or linden tree with three stems, standing in South Sweden, which gave the name to the family of Linnaeus.

8. Before proceeding with some of the myths and legends connected with our own trees, it might be interesting to mention the part which trees played in old mythological stories connected with the origin of living organisms on the earth, and with the problem of how the sky and the earth were supposed to be supported.

To early man, looking up to the heavens through the leafy forest canopy, it must have seemed that the sky rested on the tops of the trees. Then, as it seemed to recede into a remote distance, arose the fable of one particular tree which joined heaven and earth, as of the mountains which the clouds touched in other cases. We hear of a tree which, at the beginning of things, grew up above all trees till it touched the sky and darkened the sun and moon. Such a world-tree is that of the Polynesians—sixty miles high—or that other which forms a ladder to heaven. On its different sections are various repulsive insects which people dare not pass. Those who can pass reach the clear branches above from which, as they sway to and fro

in the wind, they are swung into heaven. Another conception was that the earth, not the sky, rests on a huge tree which will one day be upset by an earthquake. The living and the dead will then change places; hence the latter give the tree an occasional shake to hasten on matters—rather showing their anxiety to get back to the good things on earth. The people of Guiana know of a different kind of tree, the Céiba tree of vast dimensions, its branches in the clouds forming the seat of the Creator who made all living things from its twig and bark.

9. Trees also enter into many of the myths relating to the peopling of the earth. One race on the Gulf Coast of Australia think that once a great pine-tree reached from heaven to earth, and by its means their ancestors used to climb up and down between the two regions. To complete the story it is related that a hawk which had discovered the secret of fire making, while disputing with another hawk, set fire to the earth, thus destroying the tree. The people who had climbed up to the sky were forced to remain there. Crystals were implanted in their bodies, and the flashing of these by night causes the light of stars.

Conversely there are myths which tell how men reached the surface of the earth from below by means of a tree. Some tribes in North America think that all men once lived in the lowest depths of the earth, suffering misery. Through the intervention of the god of the interior and a huge serpent, the genius of water, they obtained a seed from which sprang a magic growth of cane. It penetrated through a crevice in the roof, and by its means men reached a higher plane of the earth's interior. Here a dim light prevailed and vegetation was produced. By another magic seed they climbed to the next stage, where the light was strong and the animals came into being. By similar magic growths, by a pine-tree or otherwise, the people, headed by two mythic twins who sang as the people climbed, reached the surface. When their song was ended no others were allowed to ascend, and they still remain below, but through the outlet still come the germs of all living things. In another Red Indian myth the ascent to the surface of the earth was made by means of a tree, which broke when the inevitable fat man or woman was climbing it, causing many still to remain below.

10. We come now to what is probably the most interesting

part in mythology, namely, the myths and legends connected with our own familiar trees. First there is the oak.

Many a fact of history is associated with the oak. The mind immediately reverts to the Druids who took their name from it and who wore its leaves as wreaths around their brow; to the civic crown of the Romans made of oak leaves, and awarded for eminent services rendered to the State; to the round oak-table of Arthur; to the arrow of Walter Tyrell, which struck against the stout trunk of an oak on its way to the heart of William II.; to the king who sheltered beneath its boughs; or to William Wallace who slept nightly in the hollow of the oak of Torwood. Often has a sight of this tree recalled the old idea of the Greeks that it was the emblem of hospitality; or the fancy of the Arcadians that it was the first created of trees. The oak was considered the emblem of hospitality by the Ancients, because when Jupiter and Mercury were travelling in disguise and arrived at the cottage of Philemon, they were treated with the greatest kindness. Philemon was turned into an oak tree and his wife into a lime, they and their entwined branches forming the magnificent portal of the Phrygian temple.

The Greeks had two remarkable sayings relative to this tree. First, "I speak to an oak," as a solemn asseveration; and second, "born of an oak," as applied to a foundling; because anciently children whom parents wished to get rid of were frequently exposed in the hollow of an oak tree.

Another saying often met with in old records, as, for example, in the "Doomsday Book," was a value of "a single hog" or "twenty hogs," as the case may be. This refers to the value placed upon oak-woods in Britain in olden times, according to the number of hogs they could fatten by means of the acorns. The survey of oak-woods was extremely rigid, and the laws enacted as to Pannage, as it is called, very strict.

The ancient legends and superstitions regarding the oak are very remarkable. According to Herodotus all the trees in the sacred groves of Dodona were endowed with the gift of prophecy, and the sacred oaks not only spoke and delivered oracles, but when some of them were cut down to build the ship "Argo," the beams and masts of that ship often spoke and warned the Argonauts of their danger. Homer says that in the sacred groves the oaks themselves spoke—hollow trees no doubt being chosen in which a priest might be concealed.

The superstitions connected with the oak in Britain are closely associated with the history of the Druids. During the earliest times the forests of Britain were not only useful as a means of subsistence and a secure retreat from enemies, but they were also devoted to the most sacred rites of religion. Groves of oaks were always favoured, and oak branches always used in the religious ceremonies. We have the picture of the Keltic Heaven god, whose image was a mighty oak, with the white-robed Druids climbing the sacred tree to cut the mistletoe and sacrificing it to the two white bulls beneath. According to mythology the discovery of the mistletoe on the oak was a circumstance of very rare occurrence, and therefore looked on as indicative of the peculiar favour of heaven, and as a certain sign that the tree on which it grew was chosen by the Deity for religious reverence. Legend informs us that in Druid times mistletoe was only found on the oak. These mistletoe-growing oaks, it is believed, were destroyed after the last of the Druids had gone. This is highly probable: but it is much debated whether it was actually the mistletoe which the Druids used in their religious ceremonies. Whatever may be the conditions necessary for the germination and growth of mistletoe on oak, they must be such as rarely coincide, or it certainly would be much more common in this country. Oak woods and oak trees border mistletoe-abounding orchards very generally, and the trees themselves are often mingled in very close alliance; indeed, it would not be too much to say, from the great occurrence of oaks in the vicinity of orchards, that the birds must sow the mistletoe seeds upon them more frequently than upon any other kind of tree. Nevertheless, in Herefordshire for example, where oaks and orchards are very common, there are very few instances of mistletoe-bearing oaks, while the plant is quite plentiful on apple trees. It is possible that the mistletoe of the Druids may be confounded with a species of Loranthus which is often found in association with oak trees in England.

A relic of Druids' time and their belief of sustaining perpetual fire was the Yule Log. This Yule Log was always made of oak. Once every year all the fires belonging to the people were extinguished to be re-lighted by the sacred fire of the Druids.

Even as late as the birth of Edward III. we have an instance of the sacred character which the oak had for the Welsh. When Edward III. was born in Carnarvon Castle, in order to

conciliate the Welsh, the cradle had to be made of oak since the natives looked upon the oak as divine.

In the mythology connected with trees the oak is probably the tree looked upon as the most divine and sacred, and all sorts of evil was supposed to fall on those who cut down any celebrated oak, as witness the story so gravely related by Evelyn concerning the so-called Vicar's oak in Surrey; that of the two men engaged in felling it, one lost his eye and the other broke his leg soon after the task had been accomplished.

11. "The wedding of the elm to the vine" is a source of continual allusion among the Roman poets. The Ancients were in the habit of twining their vines round the elm trunks, and he who reared a vineyard was as careful of his elms as of his vines—a form of protection.

Both the English elm and the Wych elm were supposed to possess divine qualities and medicinal properties. For instance, the bark of the English elm was supposed to be very effectual in cleaning the skin and making it fair, while the water in which the roots were boiled was used to prevent hair from falling out or as a hair restorer. Our ancestors also were accustomed to bruise the leaves of the elm and lay them in wounds, and ground bark was supposed to be a beneficial application to a gouty limb. The powdered inner bark of the elm is still used in North Europe as an ingredient in bread, in all probability with the idea of it acting as a medicine, for its nutritive value can be very little; while much of the tea in olden times was adulterated with elm leaves.

There are many popular superstitions too connected with the Wych elm. The origin of the name "Wych" is doubtful. It is probable that the similarity of the word to the name witch led to some popular superstitions connected with the tree, and its name may have arisen thus, as the dairymaids in some of the midland counties of England still gather a bough of this elm and place it in the churn that the milk may the more readily turn into butter. It is more likely, however, that the word was derived from the word "Wych," meaning "Salt." It appears that several elms besides the one in question were in olden times called "Wych elms"; and it is surmised that they were so called by our Saxon ancestors owing to the fact that they may have been found growing in the vicinity of salt springs.

The beech is mainly interesting in respect that from its

German name "Buche" we owe our word book, since the sides of big books were first made of beech boards. Again, among certain people, as among the Indians, it is believed to be a non-conductor of lightning. The Indians, in the prospect of a thunderstorm, always take refuge under its boughs. The same quality of being a non-conductor of lightning is said to be possessed by the birch in Russia.

Some religious associations appear to have been associated with the hazel. In certain places where excavations have been made, staves made of hazel wood have been found in the graves of ecclesiastics. The use of the forked hazel twig as a divining rod to indicate where metal lies beneath the surface of the earth is still frequent in many mining districts. Even in comparatively recent times mines have been sunk in Cornwall under the belief that the presence of metal is indicated by the bending of the hazel twig.

"The Baneful Yew," the epithet of Virgil, was particularly appropriate in times when man believed that the tree was noxious. Pliny said, "It is unpleasant and fearful to look upon, as a cursed tree without any liquid substance at all." The Ancients would not sit beneath its shadow nor touch its fruits. They would not allow their bee-hives to be placed near it, lest the bee should suck its poison, nor would they drink wine from the bowl made from its wood. Shakespeare calls it the "double fatal yew." We know now, of course, that it is only the young shoots of the yew which are malignant. Instances are known of the juicy part of the fruit of the yew having been eaten without any harmful results.

As regards the juniper, the old notion of the Ancients that the burning of the juniper wood expelled evil spirits from the dwelling probably led to some of the superstitious practices of later days with the plant. Various ceremonies connected with the burning of the wood in some parts of Scotland during the prevalence of an epidemic have led to the inference that the practice is a remnant of Druidical superstition. The alder, again, was supposed to have many medicinal virtues. A decoction was made out of alder bark, which was supposed to be very efficacious as a gargle in the case of a sore throat. A decoction of alder leaves was considered excellent against burnings and inflammations. The leaves were applied to wounds, and were recommended to be placed beneath the feet of the weary

traveller, who was promised a great refreshing by the application. The leaves and young shoots are eaten by cows, goats, horses and sheep, and Linnaeus remarks that the tongues of these animals turn black when they eat the leaves and shoots of the alder. The most interesting fact connected with the birch is that it was supposed to have provided the first writing paper in the shape of its bark. According to Pliny, the celebrated books which Numa Pompilius composed in 700 B.C., and which were buried with him, were written on the bark of the birch tree. The aspen is famous on account of the tradition among Highlanders that the Cross was made of the wood of this poplar; that the leaves shiver mystically in sympathy with the mother tree; while there is a beautiful fable connected with the large drops of clear water often found on the leaves of the black poplar in summer, that they are the tears of the sisters of Phaeton, who, while wandering on the banks of the Po, were changed into poplars. It only requires some stirring of the wind to send these tears trickling down to earth.

12. Such are a few, a very few indeed, of the many legends and traditions connected with trees. In the brief survey of these that we have made we are struck by the important role which trees must have played in ancient times. From the examples reviewed, it seems that direct and absolute tree-worship may lie very wide and deep in the early history of religion. At the present day, it looks as if we had lost something, and the loss has spoiled our appreciation of many an old poetic theme. It may not be that we need to reproach ourselves with decline in poetic taste, for it is not our sense of the beautiful which has dwindled but the old animistic philosophy of nature that is gone from us, dissipating from these stories their meaning, and with their meaning their loveliness. We still possess the ability to appreciate the beautiful in trees, and also the ability to appreciate the influence trees have on our minds. This influence is always a beneficial one. Just compare the difference of feeling created, even in the mind of the least sentimental of persons, on passing through a bare country without a tree for miles around and on wandering, especially in a warm summer day, through a country where fields and meadows alternate with inviting woodlands. One has but to turn to the lives of the poets, for instance, to find the inspiring influence which trees had on their work. Dr Samuel Johnson has made one willow

(*Salix fragilis*) famous by the delight he took in reposing beneath the full shadow given by its wide boughs and ample foliage. He used to remark that it had been the delight of his early days and of his waning life. Many are the single and grouped trees which have been celebrated for interesting associations, like the Burnham beeches, beneath which Gray wandered to be soothed in his musing by the gentle whisperings "of the nodding beeches," which, he says, "are always dreaming out their old stories of the winds." It may be said that these are poets and sentimentalists: but we are all, if not poets, at least somewhat sentimental, at any rate, as regards nature, and trees somehow must always be an attractive part of nature. Their influence on our lives cannot be too much emphasised, for they serve, for one thing, to tie us more and more to our country. Who knows but that by getting rural people to cultivate a greater interest in trees and their lore we may not take a step onward in solving the difficult problem of the migration of the rural population to towns? On the other hand, by educating townspeople in tree habits, tree names, and tree-lore, they might gain a new delight in country walks and summer holidays. At any rate, it is certain that woodmen and such-like would be much better of a little knowledge of tree-lore, if only to colour their work and make their lives more interesting. Though of less importance than the utilitarian value, the aesthetic value of trees is immense and cannot be too much exaggerated, since they greatly influence the lives of men.

30. The Biological Basis of Forestry.

By A. S. Watt.

There is, at the present time, in process of fulfilment what has been the long-cherished dream of many, who, having at heart not only the material and the social, but the intellectual and aesthetic advancement of the nation, have laboured long and tirelessly both in urging our political leaders and in educating the people towards the adoption by the country of a sound scheme of forestry. The moulding of the still plastic subject, the success of its future, where the bad effects of a scheme are not obliterated by a decade, but are handed on as undesirable heirlooms from generation to generation of foresters, require a length and clarity of vision and an intimate acquaintance with fundamental principles in order to reduce to a minimum the evil resulting from the application of imperfect knowledge, and to perpetuate the applied science of forestry upon a scientific as well as upon a sound economic basis.

The necessity for building on solid foundations will be evident to the inquirer, who has but to reflect upon the length of life of the individual tree, the initial expenditure involved in planting, and the far-distant day of realisation of his capital. An initial error of magnitude on the part of the forester means the difference between hopeless bankruptcy and the return of capital with interest. It is incumbent on the forester, therefore, to avoid as far as possible even small mistakes, to build the superstructure which he hands on to his successor upon a firm foundation.

In the modern world many industries look to the forest and ultimately to the individual tree to satisfy their varied demands. The central object of study, therefore, must be the tree not as an isolated and separate entity, an organism apart, but the tree in its structure, its functions and its relation to its environment, animate or inanimate. From the time of Liebig, when agricultural chemistry was the be-all and end-all of agricultural science, we have advanced considerably not by discarding the results of chemical and physical studies, but by elevating the plant to premier consideration, by focussing the information derived from the various departments of knowledge upon the

living, working, energy-accumulating plant itself, whose growth we set ourselves to understand.

The tree may be studied from various points of view, but the one most useful and most fundamental to all who are concerned with the rearing of plants is the physiological—the understanding of life processes. Nor must we confine our attention to a laboratory study of the plant, but seek knowledge and instruction in nature's laboratory, where for thousands of years experiments have been in progress, where the secrets of her laws and dispositions are to be obtained. In the forest there are records of past struggles, past triumphs, and present tendencies can we but read and interpret the face of nature. Our first duty is to *know* the plant, to be thoroughly familiar with its structure and its functions.

With this object in view we cannot study the tree apart from the soil in which its roots are fixed, from the atmosphere which envelops its aerial organs, nor consider it away from its neighbours. Each of these media contains factors which influence the life and growth of the tree. The numerous factors present in soil and air provide innumerable complexes of conditions for the growth of the plant—these individual factors varying within a certain range allowing of the tree's continued growth, but outside the limits imposing a check or impairing the vitality of the individual. Our business is to find out the exact complex of factors, which when supplied to the tree induce the maximum increment compatible with maximum vitality.

The three cognate applied sciences, agriculture, horticulture, and forestry have the same fundamental principles, and their respective devotees should aim at supplying the objects of their attention with optimum conditions for growth and development. To do this the farmer and gardener can control the media in which their plants live to a much greater extent than can the forester. Does not the gardener, for instance, besides controlling to a very great extent the factors of the soil, in some cases control the atmospheric medium also? Do not the farmer and gardener also control the living environment by the timely removal of undesirable species? Have they not also a quick return for their labour and capital by the cultivation of annual and biennial plants? Now the value of the forest crop is different, and the return on the initial expenditure is long delayed. It behoves the forester, therefore, to reduce the

initial expenditure, to curtail the working expenses as much as possible, and yet at the same time obtain the maximum possible return. This difference between agriculture and forestry is more than a question of degree, it compels a change of policy, a new departure in method, it demands a special technique embodied in the art of silviculture.

The claim that the science of forestry has attained its present position by a process of trial and error is not entirely borne out by facts. A little reflection will convince one that the methods of silviculture, with slight modifications, have been gleaned from nature's laboratory, where for centuries the provisions of her laws have been adhered to and have produced forests of unrivalled splendour, whose products fill our markets to-day. It is said we cannot compete with the foreigner as regards timber supplies, either in quantity or quality. We are in the majority of cases not competing directly with the foreigner, we are offering the products of an artificial system in competition with the products of woods of which nature herself has had charge. If we then are to be successful we must study nature's laws, understand her methods, discover how the tree in the old Greek phrase "lives well" under the given conditions of the home; "and having discovered to comply as well as to command: to conquer nature by observance of her laws."

And first with regard to the individual tree. The natural distribution of any species is limited by well defined factors of the environment, but within the range of its occurrence the varying complex of factors calls forth unequal responses from the tree at the limit of its range and near the centre of its natural area. In the latter, where the complex of factors, soil, atmospheric and biological, meets with the tree's demands for optimum development, there we may expect not only maximum annual increment, but maximum vitality to ward off or keep in check sundry and divers enemies. Having discovered an area where optimum development is attained our next procedure is to analyse the complex which achieves this object, find out the factors, qualitative and quantitative, chiefly responsible for the result, and from the forester's point of view associate such a complex with the species of tree concerned. Nor must we stop there. Close observation of the species of plants naturally associated with the given tree under its optimum conditions will be of very practical assistance. With each

species of tree, then, we associate a certain complex of factors, and this latter with a certain type of vegetation. Given a plantable area do we not carefully analyse its soil, climatic and biological factors, form a mental symbol representative of these, and select for planting from among the available species the one whose complex approximates most closely the factors given? If this is done then only gross mismanagement prevents success. This attitude is no new one, it is simply a restatement of what is already well known and has been practised by competent foresters for a long time. That continued reiteration of this fundamental principle, however, is necessary will be at once obvious to those under whose observation have come some of our derelict plantations—a prey to a multitude of deadly enemies, a blot on nature's handiwork, reflecting in their morbid condition the gross incompetency of the individuals responsible (well intentioned though they be) to have charge of nature's offspring.

Action in accordance with this finding does not prevent our continued planting of exotic trees, some of which will rank among our most remunerative forest crops. Some of the conifers, members of the vast forest community of Pacific North America, although prevented by geographical barriers from invading our shores, have been successfully introduced by man to a country whose climatic and soil conditions provide a habitat similar to that of their native home. But conditions vary from place to place, all do not provide the desiderata and so, instead of planting experimental plots on different soils, why can we not seek out the tree in its native home, study the complex required for optimum development and act accordingly? It would save much did we but know the conditions under which Douglas fir flourishes best in its native home, and did we but seek out here those localities suitable to it and plant the species there and there only. But the tree is plastic to a certain extent, the complex may vary somewhat, and for this allowance must be made under the new conditions. There is required then a more intensive study of the requirements of trees, and to ensure success we must be careful to see that we "plant the right tree in the right place." In this lies the first insurance of successful afforestation.

While planting in the desired complex allows of optimum development, the implication is not upheld that maximum

production of timber ensues from adherence to this policy, for it is quite conceivable that greater crops might be obtained by planting in other media. The claim, however, is advanced that under optimum natural conditions there is produced maximum yield compatible with maximum vitality. The farmer and gardener by suitable additions to the soil increase the yield, not however without undermining the resistant capacity of the plants concerned. To safeguard their crops control is extended and various artificial means are adopted to prevent, or to remedy, an outbreak of disease. The extensive area of forests, the height of the trees, the inferior value of the crop do not warrant the expenditure involved in such control. Circumstances for the time compel us to endow, as far as lies in our power, the constituent members of our woods with the maximum resistant capacity to disease. Mycologists and entomologists well know how many fungi and insects revel in the opportunity for dissolution and disorganisation afforded by suppressed and sickly trees in a wood. "Indisposition" in a tree occurs when some factor or factors of the environment become limiting, when they are present in quantities outside the range required for normal health. Under such conditions the resistant capacity of the tree to ever-present enemies is impaired, and the latter, finding conditions favourable, gain a foothold, with the result that the tree languishes and eventually succumbs. It is then at all times advisable to have the tree's maximum resistant capacities developed, and this is achieved by compliance with nature's laws. While we cannot hope to eliminate disease, we can at least establish conditions inhibiting such from becoming epidemic. If by adopting this method we do not get maximum yield of crop, the difference or loss is more than counterbalanced by the expenditure involved in protection.

In our consideration of a habitat we must include, besides the soil and climatic factors, an analysis of the living environment of plants and animals. Trees vary in their equipment for fighting other species of trees and non-arboreal vegetation, and in their capacity to resist animal attack. The occupancy of any habitat, therefore, may be determined not by inability of any species of tree to grow and flourish there, but by its inferior competitive qualities which compel retreat to localities less desirable.

The foregoing considerations in any well thought out scheme of afforestation will influence the choice of species for a par-

ticular area. In the course of the tree's subsequent development its physiological peculiarities influence the practice of silviculture. Consider, for instance, the tree's demand for light. Space does not allow of a detailed treatment, but briefly it may be indicated that since species vary in this respect, since too the demand for light varies during the lifetime of the individual, so must practice conform to the tree's requirements. Distance of planting, the age at which thinning takes place, the degree of thinning at various ages, the number of trees in the final crop, the number of trees left per unit area if natural regeneration is to follow—all depend on a knowledge of the relation of the tree to light intensities. Not only do trees' light-demands differ but these latter vary with variation of the habitat. It is sometimes due to misunderstanding in this respect that we condemn the unsuccessful introduction of continental methods. The principles remain the same, but varying conditions necessitate modifications in practice. "What we can learn from Germany and other countries with highly developed forestry is not so much their methods and systems but the principles upon which they are based, for these principles are determined by the universal laws of nature and human society."

Our study of fundamentals is by no means complete, if we confine our attention to the individual tree. Of late years the study of plant communities has progressed so far that we are in a position to apply the knowledge gained to the practice of silviculture. Just as there is a definite relation between any plant and its habitat, so there is an intimate relation between a community of plants and environment. The plant community of direct interest to us is the forest, which behaves like an organism varying from day to day and from century to century, passing through various life stages from infancy to old age and, like an organism, possessing functions and structure responding to and recording in the latter alterations of the habitat. The functions of the forest organism of chief interest here are its capacity to invade other plant communities whose habitats are being gradually modified by the addition of humus; and its power, after gaining a foothold, of ejecting ultimately the previous tenant. How then can we make use of this knowledge? According to some, millions of acres of our Scottish Highlands are afforestable, but if we reflect that for centuries seeds of forest trees have been falling on some of these desolate areas without

being able to germinate and establish themselves, that invasion of these localities has been repeatedly attempted without success, then I am sure their super-optimism would give way to something more practical. Further, if we study nature's progressive movements we ought to be able to indicate the species most suitable at any given stage, and by complying with the laws of succession, assist this progressive march in the enrichment of the soil with the object of utilising the latter in the development of our woods. Retrogression in some cases, however, replaces the onward movement, and a recognition of the occurrence of this phase enables us to adapt our methods to check further degeneration and, if possible, convert a retrograde movement into a progressive one.

"Multifarious and bewildering as the variety of its life-phases is, the forest and the changes constantly going on in it are not the disorderly results of accident. In their astonishing complexity they are yet dependent on a few simple laws of nature. To the degree in which we understand these, and their workings to that degree, we will be able to control their results. To understand clearly how much control is possible, we must bear in mind that it is done not by suspending or reversing the actions of the processes of nature, but by guiding and giving special directions to them."

NOTES AND QUERIES.

Taxation of Woodlands.

The following correspondence has taken place between the Forestry Commission and the Board of Inland Revenue, London :—

Forestry Commission,
22 Grosvenor Gardens, S.W. 1.,
20th October 1920.

Sir,—I am directed by the Forestry Commissioners to state that a question has been addressed to them as to the position of an owner who places his woodlands under Schedule D as and when they are felled and replanted.

They understand that if a woodland is cut and immediately replanted the proceeds of the cut on a three-year average will have to be brought into account, and will, subject to deduction of expenditure, be liable to taxation.

This would undoubtedly be correct when fellings take place *after* the area has been placed under Schedule D, but it is contended that, in cases where the area is under Schedule B at the time of the felling and has paid tax under that Schedule throughout the period of growth, the proceeds from it should be exempt from further taxation.

If it is decided that such proceeds are liable to taxation, the result may be that owners will, for the purpose of avoiding the tax, refrain from replanting until three years have elapsed.

In the opinion of the Commissioners this result should be avoided if possible, as, in the interests of the forest policy, denuded areas should in most cases be replanted without delay.

I am to state that the Commissioners would be glad to have your opinion on the matter.—I am, Sir, your obedient servant,

A. G. Herbert.

The Secretary,
Board of Inland Revenue.

Inland Revenue,
Somerset House, London, W.C.,
8th November 1920.

Sir,—With reference to your letter of the 20th ultimo, I am directed by the Board of Inland Revenue to state that where woodlands have been assessed under Schedule B, and the

owner elects to be assessed under Schedule D as from the date of replanting, the computation of the profit would fall to be made as in the tax of a business newly set up, no regard being had to the profits or losses arising from the woodlands in question prior to the date of replanting.—I am, Sir, your obedient servant, E. W. VERITY.

The Secretary,
Forestry Commission.

INCOME TAX: PLANTATIONS THAT CAN BE TREATED AS SEPARATE ESTATE.

The following letter from a firm of Writers to the Signet in Edinburgh to the Inland Revenue, and the reply received, will be of interest to our readers:—

COPY LETTER—Messrs J. & F. Anderson, W.S., to The Special Commissioners of Income Tax (*21st July* 1920).

DEAR SIRS,—With reference to the Rules applicable to Income Tax (Sch. B) in the First Schedule to the Income Tax Act, 1918, we shall be glad to know whether it is necessary that a proprietor should elect to have all the woodlands on his estate assessed under Sch. D to obtain the benefit in Rule 7 (*a*) of the provision with regard to woodlands planted or replanted since 19th July 1916, or whether it is competent to the proprietor to elect to have woodlands planted or replanted as above assessed under Sch. D without altering the basis of assessment in respect of the other woodlands on the estate.

We shall be obliged by your letting us hear from you as to the above at your early convenience, to enable us to give notice to the above effect to the Surveyor of Taxes for the district not later than 5th August.—Yours faithfully,

J. & F. ANDERSON.

COPY LETTER—Inland Revenue, London, to Messrs J. & F. Anderson, W.S. (*31st July* 1920).

GENTLEMEN,—With reference to your letter of the 21st instant, I am directed by the Board of Inland Revenue to acquaint you that under the provisions of Rule 7 (*a*) of Schedule B of the Income Tax Act, 1918, woodlands which are or have been

planted or replanted since the 19th July 1916 may be treated as a separate estate in respect of which election for assessment under Schedule D may be separately preferred, without altering the basis of assessment in respect of the other woodlands on the estate.—I am, Gentlemen, your obedient servant,

J. BERRY.

FORESTS OF NEW ZEALAND.

Sir David Hutchins writes to point out an error in his paper on "The Forests of New Zealand," vol. xxxiii., part 2 (1919), page 119, proof of which could not be submitted to him owing to his absence abroad. The error appears on page 120, 18 lines from bottom, where it is stated that the best of the old-time kauri forests would now have been worth £9 *per acre*; in his original MS. the words are £9 *millions*. Sir David adds that calculations given in his report on New Zealand Forestry show that the forest named would now have been worth £720 per acre.

We note with pleasure that Sir David Hutchins' services to forestry in the Empire have recently been recognised by the bestowal of a knighthood. HON. ED.

EMPIRE TIMBER EXHIBITION.

This exhibition, which was the first of its kind in scope and magnitude, was held at Holland Park Skating Rink between the 5th and 17th July, but its importance was such that it was decided to continue it a week longer than was originally intended. The exhibition was arranged by the Department of Overseas Trade, with the object of bringing into more universal use the numerous, though little known, timbers of the Empire. During the war the previous main sources of timber supply from foreign countries were cut off, and recourse was necessary to home timber and timber produced within the Empire. This proved in a practical manner the many fine qualities which such timber possesses, and there is no reason why more extended use might not be made of our home and Empire products. A large assortment of specimens of timber in various stages of manufacture were displayed, and a description was given of each sample, showing its qualities and uses as far as at present known.

In the home section attention was drawn to the many kinds of timber that may be grown successfully in the British Isles, and also to their economic importance. The Society sent a useful exhibit of home-grown timbers, also the unique collection of photographs of Scottish woodlands and forests in process of utilisation, prepared under the direction of Sir John Stirling-Maxwell.

Forests and Water Supply.

The question is often discussed as to the effect of forests on rainfall and the subsequent supply of water to springs, wells, and water-courses. While doubt still exists as to the effect of forests on the amount of aqueous precipitations, there is a general consensus of opinion that forests affect the supplies of springs and rivers, but opinions differ as to whether these supplies are decreased or increased. Cases are cited, on the one hand, where the removal of adjacent woodlands has resulted in the reappearance of dried-up springs and water-courses, while on the other hand it is held that the reverse has been observed. It would be interesting and valuable to have the experience of members and others on this subject, and those who have studied the question are invited to contribute the result of their observations to the Notes and Queries section of the *Transactions*.

The Dunkeld Hybrid Larch.

Prof. Augustine Henry, in collaboration with Miss Margaret G. Flood, has contributed to the *Proceedings of the Royal Irish Academy* a detailed study of this hybrid, based chiefly upon material obtained from Murthly. To the tree, as a first cross between *Larix leptolepis* ♀ and *L. europaea* ♂, he gives the name of *Larix eurolepis*, A. Henry, and he finds that in characters, both macroscopic and microscopic, it is remarkably intermediate between the two parents.

The naked-eye features he describes as follows:—The young shoots are either glabrous or slightly hairy, but always with some bloom on their surface, though this is less marked than in the Japanese larch. The second-year twigs resemble those of the European larch. The buds are non-resinous, light reddish-

brown; the axillary buds are very slightly overlapped at the base by the subtending pulvinus, while the terminal buds are surrounded with partly acute and partly mucronate scales. The leaves are always covered with a glaucous bloom, as in the Japanese larch, but the two stomatic bands beneath are not so white as in that species. The female flowers are deep pink, but the bracts are reflexed. The cones resemble in shape those of the European species; the scales are loosely appressed, the upper margins slightly reflexed, the basal half of the outer surface pubescent; the bracts are mostly exserted, but the tips do not project externally so conspicuously as in *L. europaea;* the peduncle is yellow.

As regards the microscopic characters the resin-canals of the pulvini of the young twigs are oval, as in *L. leptolepis;* those of the leaves of the long shoots are situated as in *L. europaea*, but may be separated from the epidermis by two layers of cells instead of one as in the latter. The resin-canals of the leaves of the short shoots are minute and indistinct, or obliterated, as *L. europaea*, while the epidermal cells of both kinds of leaves are intermediate in character, being papillate in the centre and on the outer edges, but smooth elsewhere, while those of Japanese larch are all papillate and those of the European all smooth. Prof. H. Dixon has suggested a theory explaining the function of the papillose epidermal cells of the Japanese larch; he believes that they enable this species to absorb more light and thus render it more tolerant of shade.

In the hybrid the fibro-vascular bundles of the leaves are large, as in the Japanese form, but equidistant from both surfaces, as in the European species. A table is given, showing the stomatic lines of the leaves in the three forms, which again emphasises the intermediate character of the hybrid.

Prof. Henry emphasises the vigour and good health of the plantations of the Dunkeld hybrid which he has seen, and states that at Tubney Arboretum, Oxford, a group of fourteen trees, planted in 1909, has surpassed in height a group of Japanese larches, planted three years earlier. The branches of the hybrid are ascending, and the crown narrower than in the Japanese form.

The article is accompanied by a plate, showing the mature cones of the three forms, and a series of leaf-sections, showing the resin-canals and the position of the fibro-vascular bundles.

Two Diseases new to Scotland caused by Species of *Hypoderma*.

It has often been observed that considerable damage frequently occurs in plantations of the Scots pine owing to the loss of foliage and consequent loss of increment in growth. This is often due to attack by *Lophodermium Pinastri*, but in a considerable number of cases no obvious fungus is present and the damage is consequently put down to climatic influences. Such specimens of the Scots fir, showing considerable defoliation and discoloration of the needles, were collected by Dr A. W. Borthwick near Dalmally in September of the present year, and forwarded for investigation through the headquarters of the Forestry Commission in Scotland. At the first glance the specimens showed no obvious sign of attack by a fungus, but subsequent investigation has proved that the damage is due to a fungus which has been provisionally identified as *Hypoderma pinicola*, Brunch. This species was discovered in Norway in 1892 by Brunchorst, and was subsequently recorded in Denmark and Germany. In the Scottish specimens brownish or yellowish-grey areas occur on the needles, and the abundance of these areas gives the whole shoot a greyish tinge. Examination of the discoloured areas with a lens reveals minute slits in the epidermis from which exude drops of resin. On soaking in water the slits, which are found in series on both surfaces of the leaf, open widely and reveal the elongated fructifications of the fungus. These, which are 1-2 mm. long, are pale red in colour and are covered during the earlier stages of development by a dark-coloured layer of fungal tissue which, when the fructification opens, is only seen as a narrow band just inside the ruptured epidermis. The reddish mass consists of asci and paraphyses; the asci are club-shaped and contain eight club-shaped spores each provided with a layer of mucilage; the paraphyses are long and filiform.

Brunchorst states that the disease attacks the young needles immediately after their development; after the lapse of a year the discoloration appears, the fructifications of the fungus mature in July and the needles fall in the autumn or winter of the second year. Lind, in Denmark, states that the disease is particularly prevalent during cold and wet summers.

Specimens of the fungus have been received from other localities in Scotland, and it appears that the disease is wide-

spread; considerable damage is being done by the extensive defoliation of the shoots.

Hypoderma strobicola, Rostr., a closely allied species, was found during April of this year at Murthly, causing defoliation of a specimen tree of *Pinus Strobus* var. *nana*. On the Continent this species causes considerable damage to *Pinus Strobus*, but it has not been previously recorded in Scotland.

MALCOLM WILSON.

THE OCCURRENCE OF *Botrytis Douglasii* ON THE DOUGLAS FIR.

Diseased specimens of the Douglas fir, collected by Mr J. Murray in Perthshire and forwarded through the headquarters of the Forestry Commission in Scotland, were found to be attacked by *Botrytis Douglasii*, a disease which is widespread on the Continent but which up to the present does not appear to have been recorded in this country. The specimens, which were taken from the lateral branches of a tree about 18 years old, have a very characteristic appearance. The terminal portion of the shoot is brown and withered, and the stem, as a result of the attack of the fungus, loses its rigidity and bends over a few inches behind the apex; from 4-6 inches of the branch are killed. The brown leaves near the apex usually persist, but those further back fall and the bent portion of the stem is generally bare. The delicate grey mycelium of the fungus, which can be seen with a lens on both stem and leaves, produces during the summer numerous conidia, which germinate at once in water and infect the young developing shoots and needles. In the autumn small black sclerotia are produced, and burst through the bark often under the old bud scales. These sclerotia, if kept in a damp atmosphere, produce numerous branched conidiophores which bear large numbers of conidia. In the Scottish specimens both conidiophores and sclerotia are present.

It is probable that *Botrytis Douglasii* is identical with the common saprophytic mould *Botrytis cinerea*. Several investigators have shown that it is capable of growing as a parasite on silver fir, larch, and spruce as well as Douglas fir, and it has been recorded on the larch and Scots pine in England. Under damp conditions it spreads rapidly and may cause considerable damage.

MALCOLM WILSON.

REVIEWS AND NOTICES OF BOOKS.

A Manual of the Timbers of the World, their Characteristics and Uses. By A. L. HOWARD. Pp. xvi + 446. London: Macmillan & Co., Ltd., 1920. Price 30s. net.

Mr Howard's work consists mainly of a descriptive account and catalogue of a great number of timbers. The merits and characteristics of these are discussed in a practical manner, and since the author's opinions are based on his observations over a period extending to more than forty years they are worthy of confidence. Chapters giving copies of Laslett's tables and dealing with the artificial drying of timbers are also added. These, although short, form a by no means unimportant part of the book.

The timbers are described under their trade and botanical names, and the difficulties which such a system must introduce are eliminated by the provision of two indexes. The book is produced in a pleasing style, and the numerous photographic reproductions are good.

There are misstatements but they do not mar the book's practical value. In dealing with the larch, for instance, the author is unfortunately mistaken in stating that larch "disease has practically disappeared." We have also never before seen it stated that the Romans removed larch from these shores during the period of their occupation. Then, while British-grown spruce and hardwoods are discussed at some length, there is no notice of home-grown Scots pine, which is not an unimportant timber on the market. There are also other timbers of commerce unmentioned, but this is not surprising when the numbers the author had to deal with are considered.

The work is thoroughly practical in its whole bearing and, though it does not deal with the microscopical structure of the timbers, we can recommend it as of great use to students, architects, and engineers.

Conifers and their Characteristics. By CHARLES COLTMAN-ROGERS. London: John Murray. Pp. ix + 333. Price 21s. net.

Occasionally one feels that conifers are amongst the most neglected of plants, so far as literature that will assist in the identification of the various genera and species is concerned.

Of those written in English, some of the larger volumes on the subject are excellent, others are good but have become antiquated through changes in nomenclature and the numerous introductions of new plants that recent years have seen, and practically all are somewhat beyond the purse of the average forester. A concise, accurate, and moderately priced book on conifers would be a boon.

The present work is evidently written by a lover of conifers, and its author states that he writes not for the expert but for "those who take up such subjects more in the light of secondary and subsidiary accomplishments." The book purports to give descriptions in detailed and tabular form of the various genera and species that occur. A glossary is added. There is a large amount of useful information in the book, and the author has evidently borrowed well from the larger authorities.

Of the two main parts the tables must be favoured as being most useful, but even with these we are of the opinion that the utmost care must be exercised. Tabulated methods of identification are dangerous to use, even in the case of plants whose identities are more easily established than are those of many conifers.

The detailed part of the book is written in a popular style, and one feels occasionally that too great an amount of extraneous matter is introduced.

The author would have been well advised to have called to his assistance a botanist of standing, and he might even have taken the meanings of the words in his glossary from a botanical dictionary. He would then have avoided many of the pitfalls into which the unwary non-expert is liable to fall.

The Theory and Practice of Working-Plans. By A. B. Recknagel. Second Edition. New York: John Wiley & Sons, 1917. London: Chapman & Hall, Ltd. Pp. xiv + 265, 6 plates. Price 10s. 6d. net.

Of a growing series of serviceable works on forestry subjects published by John Wiley & Sons this volume forms one of the best, and the author is to be congratulated on the production. He has brought out a volume which is valuable alike as a text-book to the student and as a book of reference for the forester. The revision benefits, as the author states, by the

work of the Committee on Terminology of the Society of American Foresters, by the criticism engendered by the first edition, by four years' experience in teaching forest management, and by the forest literature produced during that period.

The author endeavours throughout to keep to the practical view-point, and in doing so he adopts the proper attitude. The first part of his book deals with the foundations of working-plans. In this a considerable amount of attention is wisely devoted to the proper definitions of the terms used. Of chapter II. some 61 pages describe eighteen methods of determination of cut. The term "cut" here means yield in the sense that it is generally used in British works, namely, the area or volume that may be cut from a forest. We consider the American term preferable and it might be adopted here. Some critics might consider that too much space is occupied in the discussion of these methods, but on the other hand the author deals with them briefly but thoroughly and with appropriate examples, so that the descriptions enhance the value of the work. While there is much to be said in favour of Mr Recknagel's method of giving references to works dealing with certain special subjects, one feels that more might be said on rotations. To do so need not, we think, go beyond the limits of a work on forest organisation. Part II. of the book is taken up with "The Practice of Working-Plans." It gives a brief *resumé* of the general working conditions and a history of the working methods for the forests of Germany, France, Austria, and America. This forms an important section which should be particularly useful. We feel sure other editions of this book will be called for, and would suggest the inclusion of more details of French management, which here receive least attention. There is much that is good in French forest systems.

On the whole this is a volume which, in the opinion of the reviewer, should be in the hands of all forestry students and those who have the framing or application of forest working-plans.

The Fungal Diseases of the Common Larch. By W. E. Hiley. Oxford: The Clarendon Press. 12s. 6d. net.

In view of the scarcity of books dealing with the fungous diseases of trees in this country, the appearance of a work devoted to the diseases of one of our most important timber-

producing trees is particularly welcome. The publication of Mr Hiley's book arose out of an investigation of the larch canker, a disease on which many papers and articles have been published, yet one of which no complete and connected account has up to the present appeared in English.

In the introduction a general account of the life-history of a fungus is given and a description of the morphology and structure of the larch. The arrangement in which the diseases are described bears no relation to the systematic position of the species. Almost a third of the book is devoted to the canker, another third to heart-rot, and in the remaining portion *Armillaria mellea* and the fungi producing leaf and seedling diseases are dealt with. An extensive bibliography is added, and the volume is provided with an excellent index.

After a general account of the distribution and history of the larch canker, the author goes on to describe the structure of the mycelium and its effect upon the tissues of the host. It is unfortunate that in some cases the impression is given that the tree makes a conscious effort to limit the spread of the fungus, for statements of this kind are liable to lead to false conclusions as to the inter-relationships of the parasite and host. In the discussion on cell wall dissolving enzymes by parasitic fungi the omission of any reference to the late Prof. Marshall Ward's well-known paper on the lily disease is a regrettable oversight.

In the section dealing with synonymy it is shown that the fungus causing canker should be known as *Dasycypha calycina* since it was under this name that the first description about which no doubt can be entertained was given by Fuckel. Hartig considered that the species showed microdimensional differences from the saprophytic form, and in consequence suggested the name *Dasycypha Willkommii*. The author, however, by a series of cultures and infection experiments, has demonstrated that the parasitic and saprophytic forms are merely different conditions of the same species, and hence there is no justification for the retention of Hartig's name.

The question of the method of infection is fully discussed, and it is shown that the most serious cankers are produced by the fungus growing down from the dead branches into the living tissues of the trunk. Admission to the living tissues may also be gained by means of buds which have been killed

by the shading of the upper branches, but this method is less important since it only affects trees which are being killed out through lack of light. The importance of wounds in connection with infection is considered to have been over-estimated by previous investigators. The author, therefore, suggests a method of prevention of canker by the removal of dead branches in plantations from six to eighteen years old, but, as pointed out, this would prove very expensive, and there is little doubt that in a large number of cases it would be impracticable.

A detailed description of heart-rot caused by *Fomes annosus* is given, dealing especially with the secretions of the fungus and the decomposition of the wood. Cultures on artificial media and on soil are described, and the results of a number of infection experiments are given. The frequency of heart-rot in plantations forming a first rotation on old agricultural soil is discussed. The author considers that the methods of infection suggested by Hartig—by spores and by means of diseased roots coming into contact with healthy ones—are inadequate, and suggests that infection through dead roots is, in many cases, the cause of the disease. Isolation of diseased trees by trenching is not recommended as a general means of prevention on account of the labour involved, and also because of the fact that this method does not prevent the distribution by air of conidia produced on the sides of the trench. Heart-rot caused by various other fungi is also described.

Leaf diseases of the larch are comparatively infrequent in Britain, and the two caused by rust fungi are probably the most widespread. In describing the leaf blister rust the author takes it for granted that this is the aecidial stage of *Melampsoridium betulinum*, and the experiments carried out by Plowright give very considerable support to this conclusion. The wide distribution of the disease on the birch and its rarity on the larch, as well as the large number of specialised forms known to exist in closely allied genera, however, suggest caution in drawing a general conclusion of this kind. In the case of the specimens of *Peridermium laricis* obtained from Inverness-shire, no infection experiments have yet been carried out on the birch, and until these have been successfully performed the retention of the name *Peridermium laricis* is advisable.

Mr Hiley is to be congratulated on his book, which not only brings together the work carried out by previous investigators on the diseases of the larch, but contains a considerable number

of original observations and experiments. It is illustrated by a number of excellent photographs and figures, and forms a useful addition to our knowledge of disease in forest trees at a time when such knowledge is of outstanding importance.

M. Wilson.

Forest Law in America. By J. P. Kinney[1], A.B., LL.B., M.F., Chief Supervisor of Forests, United States Indian Service. New York: John Wiley & Sons. London: Chapman and Hall, Ltd.

This book is a historical presentation of the successive enactments by the legislatures of the forty-eight States of the American Union and by the Federal Congress directed to the conservation and administration of Forest Resources. It consists of 254 pages, an elaborate index covering 21 pages, and a copious table of contents. Extensive references to Laws are given both by date of the act and chapter number and often by page in its Session Laws. The preparation of the book must have involved the author in an immense amount of work, and he is to be congratulated upon the result. The book is beautifully printed in clear type on good paper, and reflects great credit on the publishers as well as on the author.

One or two historical facts may be worth mentioning, such as the institution of Arbor Day in Nebraska, in 1872, an institution which soon spread to other States. The Minnesota Forestry Association, which was the first association for the sole purpose of promoting the planting of forest trees and the general practice of forestry, was formed in 1876, and received legislative recognition in the appropriation of money for expenditure under its direction in the form of bounties for tree planting.

Colorado was the first State to incorporate in its Constitution a provision that specifically authorised a definite State forest policy, but no effective steps followed for a considerable time thereafter.

[1] This book is by the same author as *The Essentials of American Timber Law*, reviewed on page 118 of the last issue of the *Transactions*. The present review was written for that number, and was intended to precede the other review—whence the statement with which it opens that "This work is by the same author as the book noticed above." At the last moment the present review had to be held over owing to pressure on space, and, as a result of the similarity of title, a certain confusion has occurred between the two books in the January *Table of Contents*.

The American Forestry Association was formed at a Forestry Congress held at Cincinnati in 1882, and has since done an enormous amount of good work in arousing an interest in forestry in the States and in promoting a definite policy of State administration of publicly-owned forests.

California was the first State of the American Union to establish a permanent Board of Forestry, but did not maintain its lead, for we find that New York State, by its Act of 1885, which carried an appropriation of $15,000 for the expenses of the first year, was the first to pass a comprehensive Forest Administration Act in America.

As would naturally be expected a large part of the book deals with legislation for the control and prevention of forest fires—the Acts noted being very numerous. But the various States found, as continental countries had done before, that repressive measures alone were of little effect in obtaining good results, and that encouragements had to be given to induce people to take a practical interest in tree planting. This took various forms, but chiefly tax exemption and bounties to encourage the establishment of forest areas in localities naturally devoid of forests, such as the plains and prairies; also grants of land on condition that a proportion should be planted and properly tended during a period of years. The aim of a number of these Acts was the encouragement of the establishment and maintenance of farm wood lots rather than actual forest reserves.

More recent legislation in a number of States provided methods of classification of forest lands and a low valuation or total exemption from taxes for a time of such lands, provided they were managed according to agreement. They were also subject to a yield tax on the proceeds when cut for sale, but no tax was payable on timber used for fuel or for domestic purposes. Several States have recently created laws for the encouragement of the establishment and management of forests by cities, towns and other municipalities. For instance, the State of Indiana, in 1913, passed an Act providing that any five or more persons might, by written Articles of Association, organise a forestry association in any county, town or township. Upon filing these articles the Association was to become a perpetual corporation with power to establish and maintain forests. Such corporations might accept gifts of money, land or property for the purpose of acquiring and holding in perpetuity forest lands which were

not to be subject to taxation for any purpose. Counties were authorised to contribute to the objects of such associations.

Various systems of State administration are in force. In 14 States supervision is by a Board of Forestry; in 6 by an Agricultural Board; in 10 by other Boards, such as the Geological Survey or Commission, the Land Commission and similar bodies. In 9 States there is a Single Commissioner; in 15 the Board includes a technical representative, and in 29 States provision is made for the employment of an Administrative Forest Officer who, in the majority of cases, must have had a technical training as a forester. In 30 States provision has been made for the management for forestry purposes of lands held or to be acquired by the State. In 14 States the law authorises the acceptance of gifts of land for forestry purposes, and in 19 land for this purpose may be purchased. It might be added that in 22 States, spark arresters on smoke stacks must be used on locomotives during the dry season in forest regions, and in 14 States these devices must be used on stationary engines and boilers. Suitable devices upon fire-boxes and ashpans of locomotives are required in 16 States, and upon other engines and boilers in 9 States.

A considerable body of legislation regarding forestry has also been passed by the National or Federal Government, having its origin in the need for timber for the Navy; but the first real recognition of the importance of forestry investigation took place in 1877. An Act passed in that year directed the Commissioners of Agriculture to appoint a qualified person to collect forestry statistics, and in 1881 this forestry work was organised as the Forestry Division of the Department of Agriculture. In 1891 an Act was passed authorising the President to establish forest reservations, and under this and subsequent Acts immense areas have been set aside as National Forests by successive Presidents. Another Act of great importance was passed in 1911, which authorised the expenditure of large sums in the examination, survey, and acquisition of lands located at the head-water of navigable streams or of streams that were being developed for navigable purposes. By this Act means were provided for the establishment of National Forests in the Eastern States, and particularly in the White Mountains and Appalachian regions where public lands had been parted with and could now only be recovered for forestry purposes by purchase.

OBITUARY.

Mr John Boyd.

The Society has to record with deep regret the passing away of Mr John Boyd, who was well known in the forestry world and was held in high estimation by his colleagues in forestry. Of late years he occupied the position of Crown forester at Inverliever, where the skill and wide experience he brought to bear on his work were greatly appreciated at headquarters.

He contributed several papers of outstanding merit to the *Transactions*, and was the author of a small book entitled *Afforestation*, which deals with the national aspects of the subject. A very important feature of this book is a chapter which deals with the natural herbage as a guide to selection of ground to plant and the species to be used. Mr Boyd had made a long and careful study of this subject, upon which his views were accepted as authoritative.

He joined the Society in 1883, and had during his membership served on the Council, and also acted as a judge of exhibits at the Highland and Agricultural Society shows. While head forester to Sir John Stirling-Maxwell, Mr Boyd was associated with the earlier phases of turf planting, on the Belgian system, at Corrour.

Mr James A. Duthie.

The Society has also to record with deep regret the loss of Mr James A. Duthie, who was very highly esteemed by all with whom he came in contact. Mr Duthie became a member in 1900, and served for a period on the Council. He was head of the well-known firm of Ben. Reid & Co., Aberdeen. His wide knowledge of the seed business and nursery management was always readily placed at the disposal of others less well informed than himself, and his advice on such matters was always sound and practical. He introduced several new and improved methods and tools into nursery practice, among which the Duthie type of transplanting board is well known.

Mr Duthie took an active part in the affairs of the Scottish Nursery and Seed Trade Association. He was also a member of the Scottish Consultative Committee, appointed under the Forestry Act by the Forestry Commission.

Royal Scottish Arboricultural Society

Instituted 16th February 1854.

PATRON:

HIS MOST GRACIOUS MAJESTY THE KING.

PROCEEDINGS IN 1920.

THE ANNUAL MEETING.

The Sixty-seventh Annual Business Meeting of the Society was held in Dowell's Rooms, 18 George Street, Edinburgh, on Saturday, 14th February 1920, at 11 A.M. His Grace the DUKE OF BUCCLEUCH, President, was Chairman of the meeting, and there was a large attendance of members.

MINUTES.

The Minutes of the Meeting, held on 10th July last, were held as read and approved.

APOLOGIES.

A number of apologies for absence were intimated.

PRESENTATION TO SECRETARY.

At this stage the PRESIDENT said that a presentation to the Secretary, on the occasion of his semi-jubilee, would, with the leave of the meeting, now be made. He accordingly intimated that a very large number of subscriptions had been received in response to a circular which had been issued to all the members, and that the presentation was to take the form of a microscope, a piece of plate, and a cheque. These, with the congratulations of the members, he handed over to Mr Galloway, who expressed

his thanks for and appreciation of the kindness of all the members, both present and absent, who had contributed to the testimonial. The articles bore the following inscription :—

To
MR ROBERT GALLOWAY, S.S.C.,
From the Members of the
ROYAL SCOTTISH ARBORICULTURAL SOCIETY
to mark their appreciation of his high personal qualities
and his valuable services to the Society and to Forestry,
1895–1920.

REPORT BY THE COUNCIL.

The SECRETARY then read the Annual Report of the Council to the meeting, as follows :—

Roll of Honour.

As it is desirable that this Roll should be as complete as possible, a notice was inserted in the billet calling this meeting asking any members who have served with the Forces and whose names have not appeared in any of the lists published in the *Transactions*, should send particulars of their service to the Secretary. Fatal casualties not already notified should be reported. Honours and decorations should also be intimated, so that the appropriate entry may be added to the names in the List of Members.

Membership.

There has been a net increase of 90 members during the year, and the total membership at this date is now 1745. The death roll of the past year was unusually heavy. It included the following names :—Sir Hugh Munro, Bart. ; James Forbes, Islay ; Sir Simon Lockhart, Bart.; Adam Wilson ; J. Mackay Bernard ; W. K. Macdonald ; James Watson ; John Macdonald ; Lord Kyllachy ; Robert Wilson ; Thomas Wilson ; Prof. Trail ; Rev. J. H. Sheppard ; G. A. Davidson ; S. J. Drennan ; W. J. Maxwell ; Sir David Stewart ; Thomas C. Wilson ; John M'Kerchar ; Robert Grant ; John Smith ; Alex. Izat.

Council.

Mr Charles Robertson has intimated his resignation as a Member of Council, on deciding to leave for Australia.

A small Committee has been appointed to consider and report on procedure in recommending office-bearers for election at Annual Meetings.

Transactions.

The *Transactions* for January are in course of being issued to members. The expense of paper and printing has risen very much, and the cost of the *Transactions* has been under the consideration of the Council. All care has been taken to minimise this cost as far as consistent with maintaining the usual high standard of this publication.

Essays.

Four essays only were received in competition last year. A Gold Medal was awarded to Mr John Cape, of Edinburgh; a No. 1 Silver Medal to Mr Alex. S. MacLarty; and a Bronze Medal to Mr Alex. M'Pherson.

Afforestation.

The following Resolution was unanimously adopted at last Annual Meeting, namely:—

> "This Meeting of the Royal Scottish Arboricultural Society, while cordially welcoming the appointment of the Interim Forest Authority, respectfully urges the Government to pass without delay the necessary legislation, setting up a Permanent Forest Authority with Local Executives and endowed with adequate funds and the fullest powers to enable it to carry out effectively a progressive forest policy for the United Kingdom, having regard to the extent of suitable land available in each country as well as to the timber requirements of the whole kingdom."

The Resolution was despatched to His Majesty's Ministers and Departments concerned. At a later stage a copy of this Resolution and a Memorandum on Afforestation with a covering letter were sent to all the Scottish Members of Parliament.

Intimation having been received from the Interim Forest Authority that the Forestry Bill was being prepared, the opportunity was taken to suggest that power should be given to the Authority to deal with brush burning, with rabbits, insects, and other pests, and damage to plantations by sparks from railway engines.

In June the Forestry Department of the Board of Agriculture intimated that they had obtained information of great value which would enable them to make progress when the Forestry Bill became law, and that they were negotiating for the purchase of an area of land for immediate planting.

The Interim Forest Authority submitted a Memorandum with regard to proceeds-sharing schemes which was considered by the Council, who expressed the view that the grants should be considerably increased and the procedure simplified.

A copy of the Forestry Bill was submitted to the General Meeting along with a letter from Mr Acland explaining the powers of the Local Executives and Committees. The following Resolution was then submitted and carried by a very large majority, namely:—

> "That this Meeting cordially welcomes the introduction of the Forestry Bill, and hopes that it will soon be passed into law."

The Forestry Act was passed on 19th August 1919, and came into operation on the 1st day of September following. It establishes a Forestry Commission consisting of eight members holding office for five years, with large powers and a fund of three and a half millions. The Act provides for the appointment of Assistant Commissioners for England, Scotland, and Ireland, and Consultative Committees for England, Scotland, Ireland, and Wales. A copy of the Act has been printed in the *Transactions*, and will, therefore, be available to all members of the Society.

The first Commissioners, who were appointed on 29th November, are as follows:—Lord Lovat (Chairman); Mr F. D. Acland, M.P.; Lord Clinton; Mr L. Forestier Walker, M.P. (who will answer for the Commission in the House of Commons and who will represent Wales); Sir John Stirling-Maxwell and Colonel W. T. Steuart Fothringham (who will represent Scotland); Mr Ponsonby (who will represent Ireland); and Mr R. L. Robinson.

The other appointments have not yet been officially announced. The Commission has already intimated the following programme of work:—Rules of Procedure have been made, the preliminary work of the Commissioners and Assistant Commissioners have been allocated; a ten years' planting programme has been considered; the planting programme for 1919-20 has been arranged and is being carried out, and steps have been taken to meet the shortage of forest tree seeds. In addition the appointment of Consultative Committees is proceeding, and conferences with certain public departments have been held in London. In London, Dublin, and Edinburgh, schools are being arranged for the training of forestry apprentices. Statistical work is being carried out, surveys are being undertaken, and afforestable land in various parts of the United Kingdom is being inspected with a view to acquisition. An Imperial Forestry Conference is being organised for next summer.

The Council sent a letter of congratulation to the Commissioners on the passing of the Forestry Act and their appointment to office, and on the extensive programme of work which they had in hand. In recognition of the passing of the Act, the Council has also prepared the Resolution which will be submitted to this meeting.

Parliamentary Committee.

The object of this Committee was explained in last report. The Committee is now in working order and is expected to attend to the interests of forestry in Parliament.

Tax on Woodlands.

A report on the taxation of woodlands was prepared for the Council and was sent to the Interim Forest Authority, and also to the Income Tax Commission, with a request that the Commission would receive evidence from the Society on the matter. A Conference was subsequently held with the Royal English Arboricultural Society, and other societies, on the subject with the view of appointing delegates to give evidence when called on.

Education.

A Memorandum on the training of Forest Officers was prepared and sent to the Interim Forest Authority. The training of practical foresters was also further discussed, and it was agreed that two years' practical training should be required—instead of three years as previously suggested—one before taking up the theoretical course and the other, under supervision of the School Authorities, after the theoretical course is completed and before the diploma is granted. It was also suggested that the Society should recommend that a Joint Board of Examiners should be appointed for Scotland so as to standardise, as far as possible, the training required for the diploma. It was further suggested that there should be one school of practical forestry for Scotland which would grant a diploma, and that the present school at Birnam might be extended and equipped so as to be made suitable for this purpose.

In connection with the donation of £100 from a friend, it was agreed that (1) Prizes should be given for essays on Forestry subjects written by scholars in rural schools, and (2) that lantern slides and skeleton lectures should be prepared which could be lent to teachers in rural schools. A list of proposed subjects for essays by children in rural schools and a programme of illustrated lectures on forestry, which it was proposed to organise in rural districts, was subsequently prepared; but at a later meeting the Education Committee reported that as the Educational Authorities were much occupied with their new duties, and teachers were also anxious about their positions, it was thought advisable to delay pressing forward with the proposed subjects for essays and lectures for the present. Two lectures were, however, given during the winter. One on timber, by Dr Borthwick to the Associates of the Archi-

tectural Association, and the other by the Rev. John Taylor, B.D., before the Dollar Field Naturalists' Club, on afforestation, illustrated by lantern slides lent by Dr Borthwick. The thanks of the Club were conveyed to the Society for its kindness in sending Dr Borthwick to give advice regarding the lecture, and lending and explaining the lantern slides used.

Dunn Memorial Fund.

No payments having been made during the year, the amount at the credit of the Fund is now £14, 17s. 9d.

Local Branches.

Correspondence has taken place with members in the North on the subject of resuscitating the Northern Branch in Inverness, but it was thought advisable not to press this matter until there was a general desire for movement in the North.

The usual Reports from the Aberdeen Branch will be submitted to the meeting.

Chair of Forestry.

In the beginning of last year an announcement was made that the Development Commissioners had agreed to give a grant of £7000 towards the endowment of a Chair of Forestry in Edinburgh University, and the Society made a representation to the University Court urging that before any definite appointment to the new Chair was made, the qualifications of candidates should be closely examined so as to ensure that the best man available should be elected to the post.

Exhibitions.

The Exhibition in connection with the Highland and Agricultural Society's Show was resumed in the Meadows in July last year. The Timber Supply Department of the Board of Trade very kindly lent a number of huts, and made available an extensive collection of home-grown timber. Through the kindness of Sir John Stirling-Maxwell, a valuable collection of enlarged photographs of woods with appropriate inscriptions were also on view. The Exhibition was considered to be the best that had ever been held in connection with the Highland and Agricultural Society's Show. The principal exhibits, including the photographs, are to remain under the control of the Society, and will be available for future Exhibitions. A full report of the Exhibition will be found in the *Transactions*. Thanks are due to the Forestry Department of the Board of Agriculture and the Highland and Agricultural Society for valuable donations towards the expenses, and also to the

various private individuals who either lent exhibits or contributed in other ways towards the success of the Exhibition.

Later a similar Exhibition, though on a smaller scale, was held in the British Science and Key Industries Exhibition in Glasgow, the promoters of which (the Corporation of Glasgow) very kindly gave the necessary space, free of charge. A number of private exhibitors also contributed to the success of this Exhibition, including Sir Robert Lorimer and Messrs Whytock & Reid, who lent a number of beautiful articles of furniture made from home-grown oak and other timbers.

The Exhibit created an immense amount of interest amongst all classes, the stand being constantly crowded. The thanks of the Society are due to a number of willing helpers, but particularly to Mr Whitton and his staff, who devoted a great amount of time and care in arranging and caring for and returning the exhibits, and also for the interesting exhibits they provided.

It has been agreed to hold the usual Exhibition in the Show at Aberdeen next year.

Nursery and Plantation Competitions.

It has also been agreed to resume these competitions in the Show District this year.

Imperial Forestry Conference.

The Forestry Commission are promoting an Imperial Forestry Conference, which is to be held in London in the course of the summer. At the General Meeting the President reported that he was in touch with the promoters of the Conference, and would give all the help he could in the matter.

Empire Forestry Exhibition.

A Timber Exhibition is also being promoted, and will be held at the same time as the Conference mentioned above. Colonel Balfour, who represents the Society on the Exhibition Committee, reported that the various societies and others interested in home timber would be expected to contribute towards the expenses about £500, of which it was suggested that £100 should be paid by this Society. The whole matter has been gone into recently, and it has been suggested to the promoters that the societies in Scotland should contribute £200, and that this Society should provide a certain number of exhibits on condition that the similar societies and others in England should provide the remaining £300. The Council agreed that the proportion of the expenses to be made by this Society should not exceed £50, and that the Landowners' Co-operative Forestry Society, and perhaps the two Timber Merchants' Associations, might contribute the balance of the £200 required from Scotland.

Official Control of Trade in Seeds.

At the request of the Board of Agriculture, the Society was represented at a Conference on this subject and correspondence followed. It was finally decided, however, that the main object of the Control would be to deal with agricultural and horticultural seeds rather than tree seeds, but the Committee was continued to watch proceedings.

Memorial Tree Planting.

At the July Meeting Colonel Sutherland gave some indication of this movement which had been started in America and was spreading to other countries, and he suggested that the tree which the President was to plant in the Meadows at the close of that meeting should be dedicated to the memory of those members of the Society who had laid down their lives in the war. This was unanimously agreed to, and the tree was subsequently planted, through the courtesy of the Town Council, at the west end of the Meadows, near the trees planted by members of the Royal Family. The tree was the gift of Messrs Dicksons & Co., Nurserymen, Edinburgh.

At a later stage the Duke of Buccleuch intimated that he would be willing to act as President of the movement in Scotland.

Women's Work in Forestry.

At the request of the Committee on women's work connected with the Ministry of Reconstruction, Mr Leven, representing the Society, attended a Conference with the Scottish Council of women's training, and impressed upon them the desirability of retaining country women on the land rather than endeavouring to bring them back from the town into the country.

Pit-wood and Coal.

Notes on the subject of the relation of pit-wood to coal were prepared and forwarded to the Secretary of the Coal Industry Commission, with a request that the Society might have an opportunity of giving evidence on the subject, but the evidence was not called for.

Excursion.

The Council has agreed to resume the Excursions, and has appointed a Committee to make preliminary arrangements for this summer. The Committee has suggested that a district of Wales and probably the Forest of Dean should be visited. An intimation to this effect was inserted in the notice calling this meeting, and a postcard was sent out which members who desire particulars when ready could return to the Secretary. A large number of these postcards have already been returned.

Library (Appendix F).

The usual list of presentations and additions to the Library will be appended to this report when printed.

Mr Richardson asked whether anything had been done during the year with regard to his suggestion that payment should be made to writers of articles in the *Transactions*. He also referred to the question of liability for articles which were published without the names of the authors.

Prof. Wallace said that he thought great care should be exercised in connection with diploma and degree courses so as to ensure that a suitable distinction was made between them, otherwise it would be found that confusion would arise, and that those who took the longer and more expensive course for a degree might be at a disadvantage as compared with the diploma men, who would not have received the benefit of the longer theoretical training.

The President, in moving the adoption of the Report, assured Mr Richardson that the points he had raised had not been forgotten, and in reply to Prof. Wallace, indicated that he hoped there would be no confusion but the point would be kept in mind. He also referred to the point regarding the recommendation of office-bearers for election at the Annual Meeting, and expressed the hope that the Committee which had been appointed to consider this matter would be able to make such a report as would result in some method being adopted which would provide better results than the one at present in force.

In seconding the adoption of the Report, Mr Whitton referred to the Exhibition in Glasgow, which he said had been a huge success and created an immense amount of interest.

Accounts (Appendix A).

Mr Massie moved the adoption of the Accounts, and Mr Whitton seconded.

Dunn Memorial Fund (Appendix B).

This Account was read by the Secretary, and adopted.

Aberdeen Branch (Appendixes C and D).

The Reports from this Branch were submitted and, on the motion of Mr Irvine, were unanimously adopted.

Election of Office-Bearers (Appendix E).

Mr Buchanan moved, and Mr Massie seconded, the re-election of the Duke of Buccleuch as President, which was unanimously adopted. Mr Forbes moved, and Mr Macdonald seconded, the election of Mr Robert Allan as Vice-President, which was also approved.

Mr Buchanan moved, and Mr Leslie seconded, the election of the following as Councillors:—Mr James M'Laren, Gosford; Sir James Campbell, Edinburgh; Mr Gilbert Brown, Grantown-on-Spey; Mr Matthew Feaks, Darnaway, and Major Murray of Murraythwaite, M.P.

The Honorary Secretary, the Secretary and Treasurer, the Honorary Editor, the Auditor, the Honorary Scientists, and Local Secretaries were re-appointed.

Forestry Exhibition.

Mr Allan, Convener of the Exhibition Committee, drew attention to the schedules regarding the Exhibition to be held in Aberdeen this year, as well as to the Nursery and Plantation competitions to be held in the Show district there, and speaking of the Exhibitions in the Meadows and in Glasgow expressed the great indebtedness the Society was under to Mr Whitton and his staff in connection with the Glasgow Exhibition.

Excursion.

Mr Buchanan drew the attention of the meeting to the proposal that an Excursion should be made to North Wales, including, probably, the Forest of Dean and the Tintern Woods, and expressed the hope that this proposal would be acceptable to the meeting. He said there was likely to be difficulty in fitting in the Excursion with the Empire Timber Exhibition, but an effort would be made to do this if it were found possible. The report was approved.

Chairman's Remarks.

The Chairman in his remarks referred to the Exhibitions held during the past year, and also to the proposed Exhibition in the Show in Aberdeen, and to the Forestry Conference and Exhibition proposed to be held in July in London. He expressed gratification that the Society had agreed to take part in all those matters. He then moved the following Resolution which was standing in the name of the Council:—

"The Royal Scottish Arboricultural Society, in Annual Meeting assembled, desires to put on record its appreciation of, and warmest thanks for, the great services to Forestry rendered by the following in connection with the passing of the Forestry Act, 1919, viz.:—

1. The Right Hon. F. D. Acland, M.P., Chairman of the Sub-Committee on Forestry of the Reconstruction Committee, Chairman of the Interim Forest Authority, and Member of the Forestry Commission.
2. The Right Hon. Lord Lovat, K.T., D.S.O., etc., Member of the Sub-Committee on Forestry of the Reconstruction Committee, Director of Forestry with the Forces in France, Member of the Interim Forest Authority, and first Chairman of the Forestry Commission.
3. Sir John Stirling-Maxwell, Bart., Hon. Secretary and Ex-President of the Society, Assistant Controller (Scotland), Timber Supply Department, Member of the Sub-Committee on Forestry of the Reconstruction Committee, and Representative of Scotland on the Forestry Commission.
4. Colonel W. Steuart Fothringham of Murthly, etc., Ex-President of the Society, Assistant to Assistant Controller (Scotland), Timber Supply Department, Member of the Interim Forest Authority, and Representative of Scotland on the Forestry Commission.
5. Mr John Sutherland, C.B.E., formerly Member of the Board of Agriculture for Scotland, having charge of the Forestry Department of the Board, Director of the Home Timber Committee, Assistant Director of Forestry with the Forces in France, Member of the Sub-Committee on Forestry of the Reconstruction Committee, and Assistant Commissioner for Scotland under the Forestry Act."

The Society further desires, on the recommendation of the Council, to confer upon Mr Acland the Honorary Membership of the Society, in recognition of his successful discharge of the very onerous duties which devolved upon him in connection with the promotion of the Forestry Bill and its passage through Parliament."

The Resolution was unanimously adopted.

Colonel FOTHRINGHAM then addressed the meeting on the work of the Interim Forest Authority and of the Forestry Commission which has now superseded it. On the motion of the Chairman he was heartily thanked for his address.

A vote of thanks to the Chairman closed the meeting.

Note.—A detailed report of the proceedings at the meeting will be found on pp. 121-131 of Part II., Vol. xxxiv., of the *Transactions.*

THE GENERAL MEETING.

The General Meeting of the Society was held in the Highland and Agricultural Society's Showyard, Aberdeen, on Thursday, 22nd July 1920, at 2.30 P.M. Mr W. H. MASSIE, Senior Vice-President, presided, and there were about sixty members present.

APOLOGIES.

Apologies for absence were intimated from His Grace the Duke of Buccleuch, President; Sir John Stirling-Maxwell, Bart., Hon. Secretary; Messrs Buchanan, Finlayson, Fraser, Davidson, Spiers, Milne Home, Forbes, Leslie, Leven, Whitton, and Dr Borthwick, Members of Council; and also from Lord Henry Bentinck, Sir Robert and Lady Buchanan Jardine, Major Sprot of Riddell, Mr James Johnstone, Mr W. S. Curr, and Mr C. Augustus Carlow.

THE LATE MR J. A. DUTHIE.

The CHAIRMAN said that he was sure they all regretted very much the death of Mr Duthie, who had been a member for twenty years, a valuable Councillor, and a man very much respected by them all. The Council had agreed to send a letter of condolence to Miss Duthie, with which the President had expressly desired to be associated, and he asked the meeting to homologate what the Council had agreed to do. Mr IRVINE, as President of the Aberdeen Branch, seconded the Chairman's motion, which was unanimously adopted.

Minutes.

The Minutes of the Annual Meeting, which was held on 14th February last, were held as read and approved.

Essay Competition.

The Secretary reported that only one Essay had been received, and that it was at present in circulation amongst the Judges. He asked the meeting to remit to the Council to receive the Judges' report with powers.

Judges' Awards on Exhibits in the Forestry Exhibition at Aberdeen.

The Secretary read the awards of the Judges (see p. 15), which were as follows:—

Articles for Competition.

Planks of Scots pine, Norway spruce, larch, oak, and ash: 1st Prize £5—The Earl of Mansfield.

Specimens demonstrating the effects of good and bad pruning: No. 1 Silver Medal—Mr H. R. Munro, Estate Office, Charborough Park, Wareham, Dorset; No. 3 Silver Medal—James M'Hardy, Forester, Montrave.

Collection of fungi injurious to forest trees and shrubs: No. 1 Silver Medal—Mr H. R. Munro.

Articles for Exhibition Only.

Gold Medal to Messrs A. & G. Paterson, Ltd., Banchory, for their splendid series of exhibits of home-grown woods and their products embracing trees of splendid growth and dimensions, graded pit-woods, railway timbers, scantlings, and various manufactured articles including a completely equipped sectional cottage.

No. 3 Silver Medal to Messrs John Bisset & Sons, Ltd., Timber Merchants, Aberdeen, for furnished hut of special design.

No. 2 Silver Medal to Messrs Smith & Son, Nurserymen, Aberdeen, for model of improved seed kiln, designed by Wm. Bell, Forester, Seafield Estate, Rothes.

No. 3 Silver Medal to Mr John Maughan, Estate Office, Middleham, Yorkshire, for arbormeter.

No. 3 Silver Medal to Mr Alexander Murray, Dreghorn Mains, Colinton, for lever-releasing planting frame.

No. 3 Silver Medal to Messrs Ben. Reid & Co., Nurserymen, Aberdeen, for canvas shelter, planting frame and stand.

No. 2 Silver Medal to Messrs James Allan & Co., Aberdeen, for collection of furniture made of home-grown timber.

These awards were adopted.

THE AWARDS OF THE JUDGES (see p. 15) IN THE NURSERY AND PLANTATION COMPETITIONS. (Restricted to Aberdeen Show District.)

The SECRETARY read the Judges' awards as follows:—

Nursery.

Best managed estate nursery not exceeding two acres: No. 1 Silver Medal—Mr A. F. Irvine of Drum.

Plantations.

Plantation, mainly of conifers, not less than five acres in extent, and not exceeding 10 years of age: No. 1 Silver Medal—Captain Gammell of Countesswells, for 9-year-old plantation of Scots pine; Bronze Medal—Mr A. F. Irvine of Drum, for 9-year-old plantation of Scots pine.

Plantation, mainly conifers, not exceeding 20 years of age: Bronze Medal—Lord Leith of Fyvie, for 18-year-old plantation of Japanese and European larch.

Plantation, mainly conifers, not exceeding 40 years of age: Gold Medal—The King, Balmoral, for 35-year-old plantation of Douglas fir; No. 1 Silver Medal—Lord Leith of Fyvie, for 27-year-old plantation of spruce.

These awards were also adopted.

Mr ANNAND, one of the Judges, gave some interesting information about the nurseries and plantations visited, which will be embodied in the official report in the *Transactions*.

Mr ROBERT ALLAN, Convener of the Exhibition Committee, spoke of the generally satisfactory results of the Exhibition and the excellence of the exhibits. In regard to forestry Aberdeen-

shire was very much more fortunately situated than many of the districts in the south. He moved votes of thanks to the Highland and Agricultural Society for granting space for the Exhibition and contributing to the prize fund; to Sir John Fleming, Mr Gilbert Brown, and Mr Frank Scott, Judges of the Exhibits; to Dr Borthwick and Mr Annand, Judges of the Nurseries and Plantations; to Mr Geo. D. Massie, Advocate, Secretary of the Aberdeen Branch, and his Local Committee, of which Mr C. S. France was Convener. He said they all recognised the great amount of work Mr France had done for the cause of forestry.

Mr France, in acknowledging, also paid tribute to the quality of the exhibits. Referring to the Balmoral forests, he said they were greatly pleased that his Majesty the King took such a deep interest in the development of forestry.

Excursion in 1921.

The Chairman invited suggestions of localities for next year's Excursion, but none being made the matter was left to the Council.

Notice of Motion.

The following notice of motion was given by Mr Richardson, viz.:—

"That the word 'Tenant-Farmer' in Class 3, in Laws III. and VI., be transferred to Class 2."

Re-Planting Inducements.

Mr Alexander Campbell, Strathmartine, Dundee, said he wished to know what encouragement or inducement would be given by the Forestry Commissioners to proprietors who wanted to plant their land. Meantime proprietors could scarcely get plants except at excessive prices, while labour was dear, and matters seemed to be held up.

The Secretary said the Forestry Commission had been appointed and had begun its work, and Advisory Committees had been appointed for various parts of the kingdom. These Committees were supposed to give their advice on matters that might be submitted to them by the Commission. The one in Scotland had seen certain proposals in print as to the kind of encouragement that might be given to landowners, but

he was not aware that these had yet been made public. The Commission were evidently feeling their way on the subject, and endeavouring to find out through the Advisory Committees and in other ways what would be the most acceptable way in which help might be given. It was recognised that some help would have to be given, and the question was what, and how much? There would be some difficulty, perhaps, in arriving at a figure. In the report of the Committee which preceded the Commission certain sums were mentioned, but these were pre-war figures, and he did not think, if these were adequate then, that they would be adequate to-day. The difficulty of the Commission would be that it would have to deal with ante-war conditions, and would have only pre-war money with which to deal with them.

The CHAIRMAN said members of the Society must note with intense satisfaction the fact that forestry was coming into its own, and that it was now universally acknowledged to be an industry of tremendous national importance. The Society might well be proud of the part it had taken in bringing this about, but they were not to rest on their laurels. They heard a good deal about the Forestry Commission, and no doubt the Commission would always receive their sympathy and assistance if it could be given, but it was right it should know that part of the function of the Society would be to keep a critical and keen eye on what the Commission was doing.

Mr A. F. IRVINE of Drum said they were all sorry their President, the Duke of Buccleuch, was not able to be there, but they had an extremely able substitute in Mr Massie, to whom he moved a vote of thanks. On behalf of the Aberdeen Branch he extended a hearty welcome to that General Meeting of the Parent Society. They were very pleased in Aberdeen to see so many gentlemen connected with forestry among them. In that connection he mentioned that the Aberdeen Branch were holding, on 26th August this year, an excursion to Darnaway. If any gentlemen from the south communicated with Mr Galloway, or direct to the secretary of the Aberdeen Branch, Mr G. D. Massie, they would be welcome to the excursion.

This concluded the business.

6. Income Tax Recovered,					18 15 5	
7. Education Fund:—						
Sales of *Introduction to Forestry for Young People*,					0 16 0	
8. Repayment from Scottish Council of Agriculture, etc.,					3 6 2	
					£1141 2 2	

Secretary and Treasurer,				175 0 0	
Advertising, Insurance, and Premium on Secretary's Bond of Caution,				9 16 2	
Councillors' Luncheons and Railway Fares,				11 3 0	
Postages and Miscellaneous Outlays, viz.:					
Postages of Parts I. and II. of Vol. XXXIII. of *Transactions*,	£34 9 1				
General Postages, Commissions on Cheques, and Petty Outlays,	34 3 11				
				68 13 0	
				£323 12 8	
Balance at close of Accounts,					289 8 5
1. Education Fund—Balance,				£117 5 4	
2. Special Report Fund,				100 0 0	
3. Balance of Accumulated Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*, and Glasgow Exhibition,				72 3 1	
				£289 8 5	
Note.—Balance of Revenue as above,	£289 8 5				
Balance of Capital,	84 14 11				
	£374 3 4				
On Deposit Receipt with National Bank of Scotland, Ltd.,	£340 0 0				
At credit of Account current with National Bank of Scotland, Ltd.,	26 15 0				
In Treasurer's hands,	7 8 4				
				£374 3 4	
					£1141 2 2

EDINBURGH, *4th February* 1920.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1919, of which the above is an Abstract, and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me.

ALEX. J. MUNRO, *Auditor.*

APPENDIX A.

ABSTRACT OF ACCOUNTS for Year ending 31st December 1919.

I.—CAPITAL.

CHARGE.

1. Funds at 31st December 1918,		£2349 15 0
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 73½	£367 10 0	
£600 Caledonian Railway Company 4 per cent. Debenture Stock, at 79½	398 15 0	
£400 North British Railway Company 3 per cent. Debenture Stock, at 60½	240 10 0	
£400 North British Railway Company, No. 1, 4 per cent Preference Stock, at 75¾	303 0 0	
£1000 Regd. 5 National War Bonds,	1000 0 0	
	£2309 15 0	
Furniture, etc., in Society's Room,	40 0 0	
	£2349 15 0	
2. Life Members' Subscriptions in 1919,		296 16 0
New Members,	£273 0 0	
Ordinary Members by commutation,	23 16 0	
	£2646 11 0	£2646 11 0

DISCHARGE.

1. Proportion of Life Members' Subscriptions transferred to Revenue,			£197 11 1
Unexhausted.			
£190 11 1	⅞ of Full Life Subscriptions,	£171 7 4	
20 19 1	⅞ of Commuted Subscriptions,	23 3 9	
2. Furniture purchased,		£14 10 0	
3. Decrease in value of Railway Stocks since 31st December 1918,			£205 15 0
4. Funds, etc., at 31st December 1919—			
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 62,		£310 0 0	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 68,		340 0 0	
£400 North British Railway Company 3 per cent. Debenture Stock, at 50,		200 0 0	
£400 North British Railway Company, No. 1, 4 Preference Stock, at 63½,		254 0 0	
£1000 Regd. 5 National War Bonds,		1000 0 0	
		£2104 0 0	
Furniture, etc., in Society's Room, as before, say,	£40 0 0		
Additional as above,	14 10 0		
	54 10 0		
Balance of Capital being sum in National Bank,	£84 14 11		
			2243 4 11
			£2646 11 0

II.—REVENUE.

CHARGE.

1. Balance in hand at 31st December 1918 made up thus—			£323 1 6
Education Fund,	£116 9 4		
Special Report Fund,	100 0 0		
Accumulated Revenue,	106 15 2		
2. Ordinary Members' Subscriptions,			475 8 6
Arrears at 31st December 1918	£14 11 0		
Less Unappropriated,	1 2 6		
	£12 8 6		
Add Arrears written off but since recovered,	3 4 0		
	£15 12 6		
Subscriptions for 1919,	£503 4 6		
Less Received in 1918,	15 4 0		
	506 0 6		
Subscriptions for 1920 received in 1919,	9 15 6		
	£531 8 6		
Deduct—			
Cancelled or written off as irrecoverable at 31st December 1919,	£9 13 0		
Less Unappropriated as above,	1 2 6		
	8 10 6		
Arrears at 31st December 1919,	£47 15 6		
Less received but not appropriated, vendor's name being unknown,	0 6 0		
	47 9 6		
		56 0 0	
		£475 8 6	
3. Proportion of Life Members' Subscriptions transferred from Capital,			197 11 1
4. Dividends and Interest,			94 16 2
5. *Transactions* sold,			27 4 4
6. Income Tax Recovered,			18 15 5
7. Education Fund—			
Sales of *Introduction to Poultry for Young People*,			0 16 0
8. Repayment from Scottish Council of Agriculture, etc.,			1 6 2

DISCHARGE.

1. Printing, Stationery, etc.,			£466 15 11
Vol. XXXIII. Part I. *Trans.*,	£172 1 6		
Vol. XXXIII. Part II. *Trans.*,	165 16 0		
Authors' Reprints,	15 4 0		
Reprints of Vol. XXXII. for New Members,	76 19 6		
	£430 1 0		
General Printing, Stationery, Binding, etc.,	60 6 7		
	£490 7 7		
Less Receipts for Advts. in *Trans.*,	23 11 8		
	£466 15 11		
2. Exhibition Expenses,			£31 2 11
(1) Edinburgh Exhibition—			
Carriages,	£29 14 5		
Erecting and repairing huts, etc.,	60 19 10		
Printing,	7 7 6		
Attendants,	7 5 0		
Sundries,	5 9 8		
	£173 16 5		
Less Donations and Credits—			
High. & Agric. Soc., £20 0 0			
Board of Agric., 100 0 0			
Flagpole sold, 15 0 0			
Canvas sold, 13 15 0			
	148 15 0		
	£25 1 5		
(2) Glasgow Exhibition to Account—			
Carriages,	6 1 6		
	£31 2 11		
3. Prizes (Medal),			3 15 6
4. Contribution to Aberdeen Branch,			5 0 0
5. Fees to Reporters,			6 6 0
6. Removal Expenses, etc.,			8 9 9
7. Door Plate,			1 18 0
8. Expenses of Management,			323 12 8
Rent of Room and Taxes for 1919, and Hall for Annual Meeting,	£24 16 8		
Auditor,	4 4 0		
Hon. Editor's Assistant,	30 9 0		
Secretary and Treasurer,	175 0 0		
Advertising, Insurance, and Premium on Secretary's Bond of Caution,	9 16 2		
Councillors' Luncheons and Railway Fares,	11 3 0		
Postages and Miscellaneous Outlays, viz.:			
Postages of Parts I. and II. of Vol XXXIII. of *Transactions*, £34 9 1			
General Postages, Commissions on Cheques, and Petty Outlays, 34 3 11			
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	£323 12 8		
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1. Education Fund—Balance,	£117 5 4		
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3. Balance of Accumulated Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*, and Glasgow Exhibition,	72 3 1		
	£289 8 5		
Note.—Balance of Revenue as above,	£289 8 5		
Balance of Capital,	84 14 11		
	£374 3 4		
On Deposit Receipt with National Bank of Scotland, Ltd.,	£340 0 0		
At credit of Account current with National Bank of Scotland, Ltd.,	26 15 0		
In Treasurer's hands,	7 8 4		
	£374 3 4		
	£1141 2 2		£1141 2 2

EDINBURGH, 4th January 1920.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1919, of which the above is an Abstract, and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me.

ALEX. J. MUNRO, *Auditor*.

APPENDIX B.

ABSTRACT OF ACCOUNTS

IN CONNECTION WITH

THE MALCOLM DUNN MEMORIAL FUND, YEAR 1919.

RECEIPTS.

Balance in Bank at close of last Account . .	£11	17	9
Income Tax recovered to Martinmas 1918 . .	0	18	0
Dividend on £100 Redeemable Stock of Edinburgh Corporation, payable at Whitsunday and Martinmas, 1919, £3, *less* Tax, 18s. .	2	2	0
	£14	17	9

PAYMENTS.

Nil.

Balance carried forward, being sum in National Bank of Scotland on Account Current .	£14	17	9

EDINBURGH, 5*th February* 1920.—Examined and found correct. The Certificate by the Bank of above Balance, and the Edinburgh Corporation Stock Certificate, have been produced.

ALEX. J. MUNRO,
Auditor.

APPENDIX C.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (ABERDEEN BRANCH).

REPORT 1919.

The Committee beg to submit the Fourteenth Annual Report of the Branch.

The membership of the Branch is 168, thirty-two having joined during the year. The Branch has lost several members through death and removal from the district, including Professor Trail, who, since his inception in 1906, took a great interest in the Branch and who for a number of years was its President, and Sir David Stewart, of Banchory.

The past year has been one of considerable activity on the part of the Branch, and, in addition to the above gratifying accession to its membership, the proceedings have been marked by great enthusiasm throughout.

Four Quarterly Meetings were held—on 6th December 1918, 19th June, 26th July, and 25th October 1919.

At the Annual Meeting held in December, after the formal business had been transacted, the President opened a discussion on "The Future of Re-planting," which was taken part in by those present.

On the occasion of the June meeting, the members had the privilege, on the invitation of His Grace the Duke of Richmond and Gordon, of visiting and inspecting his woods at Gordon Castle, and they were afterwards entertained to luncheon by His Grace. On the same day, the party were invited to inspect the nurseries at Fochabers, owned by Messrs Christie & Son, who entertained the company to refreshments.

The July meeting also took the form of an Excursion to the woods at Glendye, owned by Sir John R. Gladstone, Bart., of Fasque, who personally conducted the party over the woods and afterwards entertained the company to luncheon.

At both Excursions there were about 80 members present, and at the Glendye Excursion the Branch had as their guests a few members of the Parent Society, including Mr Robert Galloway, S.S.C., Edinburgh, the Secretary of the Parent Society, and Mr James Forbes, Milngavie, a native of Feughside, who had the pleasure, after an absence of about 50 years,

of inspecting timber in a well-matured state which he had seen planted in his youth.

The Branch has been invited by the Parent Society to send reports dealing with the two Excursions above referred to, in order that these may be included in the *Transactions* of the Society, and it has been remitted to Mr C. S. France and to Mr Peter, Leslie to prepare the reports.

At the final meeting for the year, held in October, Mr John Michie, M.V.O , read a paper on " Practical Forestry."

The Committee again desire to record their thanks to the University Authorities for the use of the Botanical Class-room for the meetings of the Branch.

ALEX. F. IRVINE,
President.

GEORGE D. MASSIE,
Secretary.

ABERDEEN, *December* 1919.

APPENDIX D.—Royal Scottish Arboricultural Society (Aberdeen Branch).

STATEMENT OF ACCOUNTS, Year 1919.

GENERAL ACCOUNT.

INCOME.		EXPENDITURE.	
Balance at Credit of last Account	£11 14 3	Transferred to the Credit of Excursion Account to pay off balance	£1 19 0
Subscriptions from Members at 1s.	2 14 0	Two Complimentary lunch tickets and tips	0 12 0
Savings Bank Interest	0 5 5	Printing and advertising during the year	4 11 6
Grant from Parent Society	5 0 0	Secretary's Honorarium for 1918	5 5 0
		Postages and Incidents	1 11 7
		Balance at Credit of Account	5 14 7
	£19 13 8		£19 13 8

EXCURSION ACCOUNT.

From General Account to pay off Debit Balance	£1 19 0	Balance at Debit of last Account	£1 19 0
From Members for expenses of Gordon Castle Excursion	12 8 0	Excursion Expenses:—	
,, ,, Glendye Excursion	12 10 6	Gordon Castle—Teas, £3, 15s. 3d.; Hires, £9	12 15 3
Balance at Debit of Account	0 7 4	Glendye—Hires, £7, 9s. 10d.; Gratuities, 10s.	7 19 10
		Printing Circulars, etc.	3 0 9
		Postages and Incidents	1 10 0
	£27 4 10		£27 4 10

LIBRARY ACCOUNT.

Balance at Credit of last Account	£1 9 0	Books purchased	£0 4 6
		Postages and Incidents	0 1 0
		Balance at Credit of Account	1 3 6
	£1 9 0		£1 9 0

ABSTRACT.

Balance at Credit of General Account	£5 14 7
Balance at Credit of Library Account	1 3 6
	£6 18 1
Balance at Debit of Excursion Account	0 7 4
Balance at Credit of Branch, per Savings Bank Pass Book No. 393	£6 10 9

Aberdeen, 12*th December* 1919.—I have examined the foregoing Statement of Accounts, and have compared same with the vouchers, and found them to be properly stated and vouched, the balance at the credit of the Branch being £6, 10s. 9d., which is deposited with the Aberdeen Savings Bank, per Savings Bank Pass Book, No. 393, which I have also seen.

Wm. WYLLIE.

APPENDIX E.

Office-Bearers for 1920:—

PATRON.

His Majesty The King.

PRESIDENT.

The Duke of Buccleuch, K.T., Dalkeith Palace, Dalkeith.

VICE-PRESIDENTS.

W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.
J. H. Milne Home, Irvine House, Canonbie.
Lord Forteviot, Dupplin Castle, Perth.
James Whitton, Superintendent of City Parks, City Chambers, Glasgow.
Robert Allan, Factor, Polkemmet, Whitburn.

COUNCIL.

Hon. Life Members.

Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.
Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

Ordinary Members.

Chas. Buchanan, Factor, Penicuik.
Lieut.-Col. F. R. S. Balfour of Dawyck, Stobo.
Alexander Morgan, Wood Merchant, Crieff.
George Mowat, Forester, Hamilton Estates, Riccarton by Hamilton.
Peter Leslie, B.Sc., Lecturer in Forestry, Marischal College, Aberdeen.
Adam Spiers, Timber Merchant, Warriston Sawmills, Edinburgh.
George U. Macdonald, Woodbine Cottage, Peebles.
Robert Forbes, Kennet Estate Office, Alloa.
George Fraser, 7 Glencairn Crescent, Edinburgh.
Andrew Hamilton, C.B.E., 9 Denman Drive, Newsham Park, Liverpool.
James Cook, Overseer, Arniston, Gorebridge.
John Broom, Wood Merchant, Bathgate.
William Davidson, Forester, Edgerston, Jedburgh.
James Terris, Barns House, Blairadam, Kelty.
D. K. M'Beath, F.S.I., Fairfield Works, Bow, London, E.3.
William Gilchrist, Forester, etc., Mount Melville, St Andrews.
George Leven, Bowmont Forest, Kelso.
John F. Annand, M.Sc., Forestry Divisional Office (E.), 156 Union Street, Aberdeen.
Alexander Finlayson, Overseer, etc., Newbattle, Dalkeith.
A. B. Robertson, Forester, The Dean, Kilmarnock.
James M'Laren, Factor, Gosford, Longniddry.
Sir James Campbell, LL.D., 14 Douglas Crescent, Edinburgh.
Gilbert Brown, Wood Manager, Grantown-on-Spey.
Matthew Feaks, Wood Manager, Darnaway, Forres.
Major William Murray of Murraythwaite, M.P., House of Commons, Westminster.

Extra Member—President of Aberdeen Branch (A. F. Irvine, of Drum, Aberdeen).

HON. EDITOR.

Dr A. W. Borthwick, O.B.E., 25 Drumsheugh Gardens, Edinburgh.

AUDITOR.

Alex. J. Munro, 48 Castle Street, Edinburgh.

HON. SECRETARY.

Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

SECRETARY AND TREASURER.

Robert Galloway, S.S.C., 8 Rutland Square, Edinburgh.

HONORARY CONSULTING OFFICIALS.

Botanist—Sir Isaac Bayley Balfour, K.B.E., Royal Botanic Garden, Edinburgh.

Chemist—Dr Alexander Lauder, F.I.C., 13 George Square, Edinburgh.

Cryptogamist—Dr A. W. Borthwick, O.B.E., 25 Drumsheugh Gardens, Edinburgh.

Entomologist—Prof. Stewart MacDougall, 9 Dryden Place, Edinburgh.

Geologist—Dr R. Campbell, Geological Laboratory, University of Edinburgh.

Meteorologist—Andrew Watt, M.A., F.R.S.E., 122 George Street, Edinburgh.

TRUSTEES.

Lieut.-Col. W. Steuart Fothringham of Murthly, Sir John Stirling-Maxwell, Bart. of Pollok, and Sir Andrew N. Agnew, Bart. of Lochnaw, Stranraer.

LOCAL BRANCHES.

Aberdeen.

President.—A. F. Irvine of Drum, Aberdeen.

Hon. Secretary.—George D. Massie, Advocate, 147 Union Street, Aberdeen.

Northern.

President.—

Hon. Secretary.—

CORRESPONDENTS RESIDING ABROAD.

The following are Correspondents residing abroad :—

Canada, .

India, . . F. L. C. Cowley Brown, Principal, South Indian Forest College, Coimbatore, South India.

British East Africa, . } Edward Battiscombe, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.

United States of America, } Hugh P. Baker, Secretary, American Paper and Pulp Association, 18 East 41st Street, New York City.

Cape Colony, . W. Nimmo Brown, M'Kenzie's Farm, Mowbray, P.O.

Western Australia, Fred Moon, Craigian, Bighill Brook, Harren River, Manjimup.

New Zealand . R. G. Robinson, Superintendent, Selwyn Plantation Board, P.O. Box 48, Darfield, Canterbury.

South Africa . K. A. Carlson, Orange Free State Conservancy.

PHOTOGRAPHIC ARTIST.

A. D Richardson, 19 Joppa Road, Portobello.

LOCAL SECRETARIES.

Counties.	
	Scotland.
Aberdeen,	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, M.V.O., Kincairn, Blairs.
Argyll,	H. L. MACDONALD of Dunach, Oban.
Ayr,	ANDREW D. PAGE, Overseer, Culzean Home Farm, Ayr.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Berwick,	
Bute,	WM. INGLIS, Forester, Cladoch, Brodick.
Clackmannan,	ROBERT FORBES, Estate Office, Kennet, Alloa.
Dumfries,	D. CRABBE, Forester, Byreburnfoot, Canonbie.
East Lothian,	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife,	WM. GILCHRIST, Forester, Nursery Cottage, Mount Melville, St Andrews.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar,	
Inverness,	JAMES A. GOSSIP, Nurseryman, Inverness.
Kincardine,	JOHN HART, Estates Office, Cowie, Stonehaven.
Kinross,	JAMES TERRIS, Barns House, Blairadam, Kelty.
Lanark,	JAMES WHITTON, Superintendent of Parks, City Chambers, Glasgow.
Moray,	EDWARD WISEMAN, Nurseryman, Elgin.
Perth,	JOHN SCRIMGEOUR, Doune Lodge, Doune.
Ross,	
Roxburgh,	JOHN LEISHMAN, Manager, Cavers Estate, Hawick.
	R. V. MATHER, Nurseryman, Kelso.
Sutherland,	
Wigtown,	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Balcraig, Port William
	England.
Beds,	FRANCIS MITCHELL, Forester, Woburn.
Berks,	W. STORIE, Whitway House, Newbury.
Derby,	S. MACBEAN, Estate Office, Needwood Forest, Sudbury.
Devon.	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
Durham,	
Hants,	W. R. BROWN, Forester, Park Cottage, Heckfield, Winchfield.
Herts,	THOMAS SMITH, Overseer, Tring Park, Wigginton, Tring.
Kent,	R. W. COWPER, Gortanore, Sittingbourne.
Lancashire,	D. C. HAMILTON, Forester, Knowsley, Prescot.
Leicester,	JAMES MARTIN, The Reservoir, Knipton, Grantham.
Lincoln,	W. B. HAVELOCK, The Nurseries, Brocklesby Park.
Notts,	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Station Road, Tuxford.
Surrey,	JOHN ALEXANDER, 24 Lawn Crescent, Kew Gardens.
Warwick,	A. D. CHRISTIE, Hillside, Castle Road, Warley, Birmingham.

Counties.	
	England.
Wilts, . .	ANDREW BOA, Land Agent, Glenmore, The Avenue, Trowbridge.
York, . .	GEORGE HANNAH, Estate Office, Boynton, Bridlington.
	Ireland.
Dublin, . .	A. C. FORBES, Assistant Commissioner for Forestry.
	ARCH. E. MOERAN, Lissadell, Stillorgan Park.
King's County,	
Tipperary, .	ALEX. M'RAE, Forester, Dundrum.

Printed by M'Farlane & Erskine, Edinburgh.

APPENDIX F.

Additions to the Library since the publication of the List in Volume XXXIII., Part 2.

Books.

1. *Forests, Woods, and Trees in Relation to Hygiene.* By Professor Augustine Henry.
2. *Identification of the Economic Woods of the United States.* By Samuel J. Record, M.A., M.F.
3. *The Fungal Diseases of the Common Larch.* By W. E. Hiley, M.A.
4. *Conifers and their Characteristics.* By Charles Coltman-Rogers.
5. *Forest Products—their Manufacture and Use.* By Nelson Courtlandt Brown, B.A., M.F.
6. *The Theory and Practice of Working-Plans (Forest Organisation).* By Professor A. B. Recknagel, B.A., M.F.
7. *New Zealand Official Year-Book*, 1918.
8. *Kew Bulletin*, 1918.
9. *Transactions of the Highland and Agricultural Society*, vol. 31, 1919.
10. *The Harvest of Japan.* By C. Bogue Luffmann.

Government and State Reports.

11. England:—*Report of Commissioners of H. M. Woods, Forests, and Land Revenues*, 27th June 1919.
12. India:—
    (1) *Statistics relating to Forest Administration*, 1917-18.
    (2) *Report of Forest Department of Madras*, 30*th June* 1919.
13. Indian Forest Records:—
    Vol. vii., part 2—*A Further Note on Thitsi (Melanorrhoea usitata*, Wall).
    ,, ,, 3—*Note on Hopea Canarensis*, Hole.
    ,, ,, 4—*Note on Ixora Butterwickii*, Hole.
    ,, ,, 5—*Notes on the Larvae and Life Histories of Prionine Beetles, Coleoptera Cerambycictae Prionini.*
    ,, ,, 6—*Note on the Mechanical Strength and Seasoning Properties of Shorea robusta (Sal) Timber.*
14. Indian Forest Bulletin No. 39: *Note on Hollong Timber, Dipterocarpus pilosus*, Roxb.
15. Canada:—
    (1) *Report of Director of Forestry*, 1919.
    (2) *Utilisation of Waste Sulphite Liquor.*
    (3) *Forest Fires in Canada*, 1917.
    (4) *Pulverised Fuel. Commission of Conservation.*
    (5) *Power in Alberta.* ,,
    (6) *Seasonable Hints. Dominion Experimental Farms.*
    (7) British Columbia: *Report on Forests—Commission of Conservation*, 1918.
    Report of Forest Branch, 1919.
    (8) *Conservation in* 1918. 10*th Annual Report.*

16. Western Australia :—
    (1) *Report of Forests Department*, 30*th June* 1919.
    (2) *The Kiln Drying of Jarrah.* Bulletin No. 1. Forests Department.
    (3) *Leaflets by Forests Department.*
17. South Australia :—*Report of Woods and Forests Department*, 1918-19.
18. Queensland :—*Report of Director of Forests*, 1918.
19. New Zealand :—
    (1) *New Zealand Forestry*, Part I. By D. E. Hutchins.
    (2) *Report on State Forestry*, 31*st March* 1919.
20. Union of South Africa :—*Report of Forest Department*, 31*st March* 1919.
21. Federated Malay States :—*Report on Forest Administration*, 1918.
22. United States of America :—
    (1) Pennsylvania :—*Chief Forest Fire Warden's Report*, 1918.
    (2) New York State :—*Technical Publications, Nos.* 2, 9, *and* 11, *of the State College of Forestry.*
    (3) California :—*Publications of the College of Agriculture.*

Societies' and Institutions' Reports and Transactions.

23. England :—
    (1) *Forestry Quarterly.*
    (2) Association of Economic Biologists. *Annals of Applied Biology*, vol. vi., Nos. 1, 2, 3 and 4.
    (3) *Journal of the Royal Agricultural Society*, vol. lxxix.
    (4) *Journal of the Royal Horticultural Society*, vol. lxxiv., 1919.
24. Scotland :—
    (1) Royal Botanic Garden :—*Notes for January, July, October and November* 1919.
    (2) *Transactions of Perthshire Society of Natural Science*, vol. vii., part 1, 1918-19.
    (3) *The Glasgow Naturalist*, vol. viii., Nos. 3 and 4.
25. *Nova Scotian Institute of Science, Transactions*, vol. xiv., part 4, 1917-18.
26. Massachusetts :—*Horticultural Society, Transactions*, part 1, 1919.

Reprints and Miscellaneous.

27. Journal and Leaflets of the Board of Agriculture. London.
28. Journal of the Board of Agriculture for Scotland.
29. Journal of the Department of Agriculture. Ireland.
30. *Journal of Agriculture.* Victoria.
31. *The Estate Magazine.*
32. *L'Alpe.* Firenze.
33. *Det Forstlige Forsøgovaesen.* I. Danmark, part 3.
34. *Tidskrift for Skogsbrug.* Christiania.
35. *Skogsvårdsföreningens Tidskrift.* Stockholm.
36. *Meddelanden Från Statens Skogsförsöksanstalt.* Stockholm.
37. *The Indian Forester.*
38. *Journal of Forestry.* Washington.
39. *American Forestry.* Washington.

40. *Canadian Forestry Journal.*
41. *Timber Trades Journal.*
42. *Timber News.*
43. *National Forestry.* Address by D. E. Hutchins to New Zealand Forestry League.
44. *Phases of Forestry Practice.* Address by R. G. Robinson to Philosophical Institute, Canterbury, New Zealand.
45. *The Archives of the Cambridge Forestry Association,* Nos. 2 and 3, April and May 1920.
46. *The Mean Annual Forest Per Cent.* By W. E. Hiley (Reprint).
47. *The Douglas Firs: A Botanical and Silvicultural Description of the various Species of Pseudotsuga.* By Augustine Henry and Margaret G. Flood.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON:

HIS MOST GRACIOUS MAJESTY THE KING

PROCEEDINGS IN 1919.—*Continued.*

THE GENERAL MEETING.

The General Meeting of the Society was held in the Meeting Room in the Highland and Agricultural Society's Show Yard, Edinburgh, on Thursday, 10th July 1919, at 2.30 P.M. His Grace, the DUKE OF BUCCLEUCH, K.T., President, was in the Chair, and there was a very large attendance of members.

APOLOGIES.

Apologies for absence were intimated from Sir Andrew Agnew, Mr C. W. Forbes of Callander, Mr Thorburn of Glenormiston, Col. Hume of Auchendolly, The Earl of Lindesay, Col. Forbes of Rothiemay, Mr Hagart Speirs of Elderslie, Mr George Fraser, Dalzell, Mr A. Alexander, Kew, Mr George Mowat, Hamilton, Mr J. F. Annand, Chopwellwood, and others.

MINUTES.

The Minutes of the Annual Meeting, held on 8th February last, were held as read and approved.

REPORT OF THE JUDGES ON ESSAYS.

The recommendations of the Judges were submitted and agreed to, as follows:—

A Gold Medal to Mr JOHN CAPE, 86 Spottiswoode Street, Edinburgh, for his paper on "Measurement of Timber."

A No. 1 Silver Medal to Mr Alex. S. M'Larty, Forester, Glasserton, for his paper on "Forest Tree Seeds."

A Bronze Medal to Mr Alex. Macpherson, Forester, Poltalloch, for his paper on "Timber Prices."

No award was made to the writer of a paper on "Rabbit Jumps."

Mr Milne Home said that the first two essays were very good, and that Mr Cape's on measurement of timber well deserved a gold medal, which had been awarded. He hoped that these awards would be an encouragement to writers to increase their efforts to attain a higher standard of writing in future.

Forestry Exhibition.

Mr Allan, Convener of the Exhibition Committee, gave in the Report, and moved a vote of thanks to all who had assisted either by providing material or by personal help in connection with the matter. He said that it was probable that the exhibits which had been brought together would be retained, as far as possible, so as to form the nucleus of a permanent collection and made available for exhibition purposes and probably in course of time for a national collection. Mr Brand of the Timber Supply Department and Mr Richardson also referred to the Exhibition.

Memorial Tree Planting—Trees of Remembrance.

Col. Sutherland explained the purpose of this movement, and asked the members to give their support as far as they could as he believed it would greatly stimulate interest in tree planting, and also in the care and preservation of trees after they had been planted. He suggested that the tree which the President was to plant in the Meadows should be dedicated to the memory of those members of the Society who had laid down their lives in the war, and this was unanimously agreed to.

Proposed Imperial Forestry Conference.

The President reported that he was in touch with the promoters of this Conference, and that he would give what help he could in the matter. Further progress would be

reported when occasion arose. Lord Lovat also referred to the movement, and said that he hoped it would be a successful meeting.

Aberdeen Branch—Excursion to Glendye.

The Secretary intimated that the Aberdeen Branch were to hold an excursion to Glendye on Saturday, 26th July, and that a cordial invitation from the Branch was extended to all members of the Society to be present. He invited those who intended to take part in this excursion to give their names to him so that the necessary arrangements could be made.

Forestry Bill.

The Secretary submitted this Bill, and read a letter from Mr Acland with regard to the powers of the local Executives and Committees. The President submitted the following Resolution, namely:—

> "That this Society cordially welcomes the introduction of the Forestry Bill, and hopes it will be soon passed into law."

He regretted that application required to be made to the Development Commissioners in the event of the Forest Commission desiring to exercise compulsory powers, and he held that this should be remedied. Mr Whitton seconded the motion.

Mr Richardson criticised the Bill, and moved the following amendment:—

> "That while this Society welcomes the introduction of the Forestry Bill into Parliament, it strongly protests against the constitution of the Central Authority in so far that no provision is made for Scotland's claim to a representation thereon commensurate with her needs; that no qualifications either for the post of Commissioner or Assistant Commissioner are mentioned in the Bill; and it also protests against the constitution of the Consultative Committees in so far that none of the members whom it is proposed to appoint may have practical or scientific knowledge of silviculture."

Mr Menmuir seconded Mr Richardson's amendment.

Sir John Stirling-Maxwell, Sir Hugh Shaw Stewart, Mr Milne Home, and Lord Lovat spoke in favour of the Resolution. The latter said that he would bring the several points before the Chairman of the Interim Forest Authority with a view of having them submitted to the War Cabinet. Mr Richardson asked that a vote should be taken, when twelve voted for the amendment, and an overwhelming majority for the motion, which was accordingly declared carried.

Memorial Tree Planting.

At the close of the meeting the members adjourned to the west end of the show ground where the President planted the Memorial Tree referred to above. The Tree was the gift of Messrs Dicksons & Co., Nurserymen, Edinburgh.

Note.—For further details regarding this meeting see pp. 1-12 of Part I., Vol. xxxiv., of the *Transactions*.

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